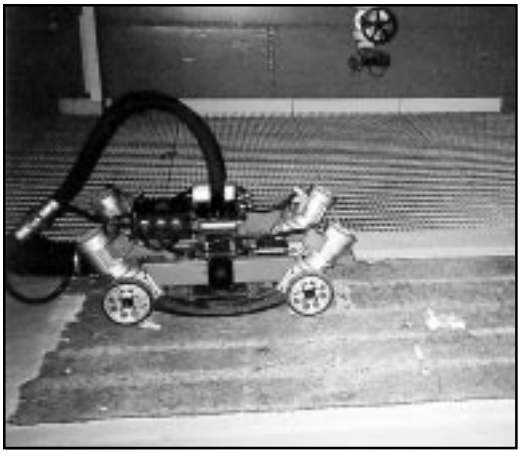
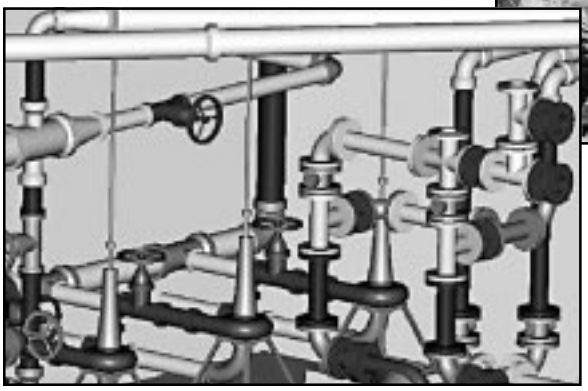
Deactivation and Decommissioning Focus Area

QUARTERLY REPORT – JULY 2000

April – June 2000 Activities





Office of Science & Technology

NETL

D&D Focus Area

On the Cover

Clockwise from Upper Left:

The **En-Vac Robotic Wall Scabbler**, has been deployed at INEEL's TAN North Gallery.

The **Concrete Crusher** has been deployed at INEEL as part the Integrated Decontamination and Decommissioning ASTD.

Demonstrated in the INEEL LSDDP, the **Global Positioning Radiometric Scanner (GPRS)** system has subsequently been deployed twice at the TAN 3XN.

The **DDROPS** has been deployed at INEEL as part of the Integrated Decontamination and Decommissioning ASTD

The purpose of this document is to provide an overview of the Deactivation and Decommissioning D&D Focus Area and to update readers on the program's current activities. It presents a synopsis of the current program status and recent accomplishments, along with overviews of planned activities, program issues, and opportunities. Quarterly reports are distributed to U.S. Department of Energy DOE headquarters and operations office managers, site personnel, site operating contractors, technology developers, principal investigators, regulators, and other stakeholders. Issued in January, April, July, and October, the D&D quarterly reports summarize the activities of each preceding quarter. The D&D Update is published in all other months, introducing new projects and highlighting advances in ongoing projects. Quarterly reports, monthly updates, and further information about the D&D Focus Area DDFA are found on the World Wide Web at *www.netl.doe.gov/dd*. Technologies are usually identified by their discrete tracking numbers within the Technology Management System TMS operated by DOE's Office of Science and Technology OST. Providing access to information about OST programs, technologies, and linkages to EM problems, TMS is found on the World Wide Web at *ost.em.doe.gov/tms/home/entry.asp*.

D&D Focus Area Contacts

Focus Area Lead

Robert C. Bedick, DOE-NETL
304–285–4505, rbedic@netl.doe.gov

DOE Headquarters Program Manager

Jerry Hyde, DOE-HQ
301–903–7914, jerry.hyde@em.doe.gov

NETL Project Managers

Steve Bossart, DOE-NETL
304–285–4643, steven.bossart@netl.doe.gov

John Duda, DOE-NETL
304–285–4217, john.duda@netl.doe.gov

Vijendra Kothari, DOE-NETL
304–285–4579, vijendra.kothari@netl.doe.gov

Jane Powell, DOE-NETL
304–285–4687, jane.powell@netl.doe.gov

Nelson Rekos, DOE-NETL
304–285–4066, nelson.rekos@netl.doe.gov

Harold Shoemaker, Ph.D., DOE-NETL
304–285–4715, harold.shoemaker@netl.doe.gov

D&D Updates and Reports

Comments, address changes, address corrections

Wade Walker, RIO Technical Services
817–735–8264, wade.walker@riotechnical.com

Table of Contents

D&D Focus Area

1.0 HIGHLIGHTS

Deactivation and Decommissioning Focus Area Has $1.5 Billion in Committed Cost Savings from Deployment of Its Improved Technologies

The National Energy Technology Laboratory's (NETL) Deactivation and Decommissioning Focus Area (DDFA) calculated a cost savings of $1.5 billion based on deployment of its improved decontamination and decommissioning (D&D) technologies in DOE's past and future deactivation and decommissioning projects. The savings include over $13 million of actual cost savings from past D&D projects and committed future cost savings from Accelerated Site Technology Deployment (ASTD) projects, Value Engineering studies, and committed deployment of improved technologies at Fernald, the Idaho National Engineering and Environmental Laboratory, Hanford and other DOE sites. One goal of the DDFA is to reduce the $33 billion mortgage to deactivate and decommission the DOE's surplus facilities by about 40 percent or $13 billion. The $1.5 billion of committed cost savings is a good start in achieving this goal considering $4.5 billion will be spent on DOE's deactivation and decommissioning projects before FY 2006.

For more information:

Steven Bossart, DOE-NETL
304–285–4643
steven.bossart@netl.doe.gov

Bob Bedick, DOE-NETL
304–284–4505
robert.bedick@netl.doe.gov

International Decommissioning Symposium (IDS) 2000

On June 12-16, 2000, NETL's DDFA participated in the Fourth U.S. Department of Energy International Decommissioning Symposium (IDS 2000) in Knoxville, Tennessee. Projects and technologies in the DDFA program contributed substantially to the success of IDS 2000. Nearly 30 papers on technologies and projects in the DDFA program were presented at IDS 2000 and nearly half of about 100 exhibits featured technologies or projects sponsored by the DDFA. In addition, about 700 national and international participants in IDS 2000 had the opportunity to witness a unique conference event in which eight technologies sponsored by DDFA were demonstrated in an outdoor area. IDS 2000 also proved to be an excellent opportunity for transfer of DDFA's technologies as both vendors for the oxy-gasoline cutting torch and personal ice cooling system (Sec. 2.1, Pg. 20) sold units during the event.

For more information:

Steven Bossart, DOE-NETL
304–285–4643
steven.bossart@netl.doe.gov

personal ice cooling system

Diamond Wire Cutter

Columbus Environmental Management Project Awarded New ASTD Project

The Columbus Environmental Management Project was awarded an ASTD project to deploy a diamond wire saw system to size reduce an activated bioshield and associated structures in a decommissioned research reactor at Battelle's West Jefferson site in Columbus, Ohio. The bioshield is made of high-density concrete approximately eight feet thick with an extensive internal latticework of carbon steel reinforcement bars. This technology was used successfully in decommissioning projects at Fort St. Vrain and Shoreham Nuclear Power Plants, but has seen little application within DOE's decommissioning projects. The estimated cost to size reduce the Building JN-3 bioshield at West Jefferson is $780,000 using the diamond wire saw compared to an estimated cost to dismantle the bioshield with the baseline technology of heavy jackhammers at $1,051,000. Thus, size reduction using the diamond wire saw represents a cost saving of about 25 percent compared to the baseline approach. Subsequent deployments of the diamond wire saw are planned for Mound and West Valley.

For more information

Steven Bossart, DOE-NETL
304–285–4643
steven.bossart@netl.doe.gov

Fernald Environmental Management Project Awarded Two New ASTDs

Reducing, Reusing, and Recycling Concrete and Segmenting Plate Steel and Tanks Utilizing a Universal Demolition Processor—Accelerated Site Technology Deployment

As decontamination and decommissioning work at Fernald progresses from above-grade facilities to at-grade and below-grade facilities, there will be a bona fide need for new technologies to process concrete.

Fernald can realize significant cost savings by reprocessing and reusing a portion of the site's concrete. There is a defined need for aggregate to build and strengthen the site's transportation infrastructure in and around the On-Site Disposal Facility (OSDF). Project personnel in the Soils and Water Division have an estimated need for up to 15,000 cubic yards of aggregate per year, for the next six years. Not recycling the site's concrete means that tons of aggregate will have to be trucked in from offsite and subsequently disposed in

the OSDF. Reprocessing a portion of the concrete saves the costs associated with the purchase of virgin aggregate and its subsequent disposal cost. The site can also realize increases in safety, efficiency, and schedule by utilizing the plate shear capability of the universal processor. Fernald has numerous large, heavy steel tanks including two water towers and numerous tanks made of stainless steel.

To address the site's needs, EM's Office of Science and Technology (OST) has partnered with FEMP in an ASTD project with OST providing $800,000 for this deployment. Through the activities in this project, innovative technologies will be deployed to accelerate demolition/recycling of construction materials for road construction, and for segmenting large, hard to cut, plate steel and tanks. Overall decommissioning life-cycle costs are expected to be significantly lowered via the deployment of these technologies.

Improved Measurement and Monitoring Systems—Accelerated Site Technology Deployment

The Fernald Environmental Management Project (FEMP) is a 1,050-acre DOE Closure Site currently undergoing decommissioning and environmental restoration. As environmental cleanup work at the FEMP accelerates towards closure and long-term stewardship, there is an increasing need for new, innovative technologies to perform real-time physiological monitoring, land surveying, and wireless radon monitoring.

In the process of deactivating and decommissioning DOE facilities, individual laborers sometimes need to work in/near radiological and hazardous locations, and in situations that lead to extreme physical conditions. At FEMP, these types of extreme conditions will likely occur in the upcoming FEMP Silos project and in other restoration projects across the site. Technologies are needed that reduce workers' risk during engineering, construction, and environmental restoration operations. To minimize these risks, three new technologies have been identified for deployment at FEMP. Collectively, these technologies will provide for the monitoring of worker vital signs, improved land surveying, and the remote transmission of radon monitoring data.

For more information:

Kathleen Nickel, FEMP
513–648–3166
kathleen.nickel@fernald.gov

Larry Stebbins, FEMP
513–648–6218
lawrence.stebbins@fernald.gov

John Duda, DOE NETL
304–285–4217
john.duda@netl.doe.gov

Miamisburg Environmental Management Project Awarded New ASTD Project

Recently the Miamisburg Environmental Management Project was awarded an ASTD project to ascertain the nature and extent of contamination in an area under SW Building known as the "Old Cave." The Old Cave is actually the entombed remains of a 1950's hot cell, which must be removed before the City of Miamisburg, Ohio, will accept ownership of the Mound site. In SW Building, the Old Cave is located under an area designated SW-19. Because of lack of knowledge of what all is in the Old Cave area, ultra conservative estimates of the amounts of Ac-227 and Ra-226 have been made which required the Old Cave to be classified as a Category 2 Nuclear Facility. It is considered highly unlikely that that much radioactive material resides in the Old Cave. The approach is to characterize SW-19, the surroundings, and the entombment. In Phase I - Non-Invasive Investigations, they plan to characterize the entombment using ground penetrating radar and time-domain electromagnetics, gamma spectrometry, drain exploration, and radon monitoring. In Phase II - Invasive Investigations, they plan to perform these investigations with respect to the entombment via diamond core drilling and/or Geoprobe with a real-time position location determination device. Once better defined radioactivity levels

are determined, and a final design decision to the Baseline Plan is made, several enhancements that shorten the schedule and reduce costs may result. A baseline recovery of only one-week would recoup the entire ASTD investment. If the baseline acceleration is greater than the one week, the return on investment will increase proportionally as additional weeks/months are saved from the baseline. Based on the Value Engineering study, it is conservatively estimated that four months can easily be recovered when compared to the present technical approach.

For more information:

Harold Shoemaker, Ph.D., DOE-NETL
304–285–4715
harold.shoemaker@netl.doe.gov

Rocky Flats Awarded Three New ASTDs

Decontamination of Gloveboxes, Tanks, and Equipment for Shipment and Disposal

This new ASTD supports the deployment of a suite of decontamination technologies to allow shipment and disposal of plutonium-contaminated gloveboxes and equipment while obviating size reduction requirements. By reducing surface contamination, gloveboxes and other equipment can be disposed of as LLW per DOT criteria, thus minimizing the total waste volume of material to be shipped to WIPP. Total cost savings to the Site's life-cycle baseline is estimated at $45.2 million.

Remote In-Situ Reduction of Plutonium Contaminated Gloveboxes and Equipment

This new ASTD supports the deployment of a number of improved tools for the removal of large plutonium-contaminated gloveboxes and equipment that must be size reduced in place. These improved tools comprise the In-Situ Size Reduction System (ISSRS) for automated size reduction activities in Buildings 771, 371, and 776/777. The ISSRS will minimize personnel radiation dose and enhance safety, while providing an estimated life-cycle savings of $13.7 million.

By reducing surface contamination, glove boxes and other equipment can be disposed of as LLW per DOT criteria, thus minimizing the total waste volume of material to be shipped to WIPP. Total cost savings to the Site's life-cycle baseline is estimated at $45.2 million.

Upgrade RAD Instrumentation of RFETS

This new ASTD will support the deployment of a broad array of state-of-the-art instrumentation technology to accelerate baseline D&D activities, improve worker safety, and significantly reduce RFETS closure costs. Possible technologies to be deployed include the Long-range Alpha Detector (LRAD), an improved 3-D gamma imaging system, a glovebox glove failure alarm system, systems for automated waste inspection and tracking, and a beryllium air monitor. Life-cycle cost savings for this ASTD are estimated in excess of $12 million.

For more information:

Jane Powell, DOE-NETL
304–285–4687
Jane.Powell@netl.doe.gov

Rosie Ready for Showcasing in Tennessee

The Rosie Mobile Work Platform was developed by RedZone Robotics and Carnegie Mellon University under the support of the National Energy Technology Laboratory's (NETL's) Industry/University Program. Rosie is a tether-powered, four-wheeled robotic platform used to perform decommissioning tasks using various end effectors attached to the end of a 25-foot manipulator. Rosie can be remotely operated at distances up to 500 feet away using a teleoperated system. Currently, Rosie is being used to dismantle and size reduce equipment and piping systems inside the radiologically-contaminated Building 1420 at Oak Ridge's East Tennessee Technology Park under a fixed-price decommissioning contract with Decon Recovery Services (DRS). RedZone Robotics is providing consultation services to DRS to assist in deployment of Rosie in the project. On June 12–16, 2000, about 800 attendees at IDS 2000 in Knoxville had the opportunity to witness the capabilities and versatility of Rosie during a live demonstration. Previously, the benefits of Rosie were demonstrated and deployed in the Chicago Pile 5 Research Reactor LSDDP under the support of NETL 's Deactivation and Decommissioning Focus Area.

For more information

Steven Bossart, DOE-NETL
304–285–4643
steven.bossart@netl.doe.gov

Florida International University Successfully Decontaminates Pipe at Big Rock Point

Using its mobile integrated characterization and decontamination system, Florida International University (FIU) is decontaminating and surveying radioactive pipe resulting from decommissioning activities at Consumers Energy's Big Rock Point Nuclear Power Station near Charlevoix, Michigan. This system includes four separate modules for decontamination, ventilation, characterization, and offloading clean pipe. Grit blasting is used to clean the interior and exterior of the pipe in the decontamination module and the characterization module includes gamma detectors to confirm that the pipe is clean and can be free released to the scrap metal market. Currently, the system is processing pipe with contamination levels up to 100,000 disintegrations per minute per hundred square centimeters. The demonstration will conclude in early July 2000. Based on this successful demonstration, DOE and several nuclear utilities are expected to use the mobile integrated characterization and decontamination system to decontaminate and free release pipe as a cost-effective alternative to disposal as low-level radioactive waste. FIU is performing this work under its grant with the NETL.

For more information:

Steven Bossart, DOE-NETL
304–285–4643
steven.bossart@netl.doe.gov

2.0 Project Summary Table

The following table summarizes the Technical Task Plans for the D&D Focus Area Core Program and related Crosscutting and Industry Program contracts. Project descriptions follow in subsections 2.1 through 2.5 and are organized by the work breakdown structure WBS element listed here.

Project Number	D&D WBS Element	Project Name	Page
AL08DD21	Demonstrations and Industry Approaches	Large-Scale Demonstration: Los Alamos National Laboratory Transuranic Waste	10
OH08DD21	Demonstrations and Industry Approaches	Large-Scale Demonstration: Mound Tritium Facilities	11
ID08DD21	Demonstrations and Industry Approaches	Large-Scale Demonstration: Idaho National Engineering and Environmental Laboratory Fuel Storage Canals and Underwater and Underground Facilities	13
RL08DD21	Demonstrations and Industry Approaches	Canyon Disposition Initiative	15
SR09DD61	Demonstrations and Industry Approaches	Highly Selective Nuclide Removal System—Accelerated Site Technology Deployment	16
OH19DD61	Demonstrations and Industry Approaches	Mobile Work Platform—Accelerated Site Technology Deployment	17
RL09DD61	Demonstrations and Industry Approaches	Remote Size Reduction for Large Hot Cell Deactivation—Accelerated Site Technology Deployment	18
NV09DD62	Demonstrations and Industry Approaches	Surface Contamination Monitor—Accelerated Site Technology Deployment	18
AL08SD10	Demonstrations and Industry Approaches	Los Alamos National Lab Decontamination and Volume Reduction System—Accelerated Site Technology Deployment	—
NV09DD61	Demonstrations and Industry Approaches	Oversize Transuranic Waste Laser Cutting System, Nevada Test Site—Accelerated Site Technology Deployment	19
OH19DD62	Demonstrations and Industry Approaches	Personal Ice Cooling System—Accelerated Site Technology Deployment	20
ID08SD11	Demonstrations and Industry Approaches	Integrated Decontamination & Decommissioning—Accelerated Site Technology Deployment	21
ID79DD61	Demonstrations and Industry Approaches	Release of Concrete for Recycle from D&D Projects—Accelerated Site Technology Deployment	22
CH39DD63	Demonstrations and Industry Approaches	Deployment of Innovative Characterization Technologies and Implementation of the MARSSIM Process at Radiologically Contaminated Sites—Accelerated Site Technology Deployment	23

Project Number	D&D WBS Element	Project Name	Page
RF09D21 RF08SD10 RF09DD61	Demonstrations and Industry Approaches	Rocky Flats Environmental Technology Site—Accelerated Site Technology Deployment and the D&D Initiative	—
	Demonstrations and Industry Approaches	Deactivation and Decommissioning Consortium	24
Multiple Projects	Demonstrations and Industry Approaches	Florida International University	24
Multiple Projects	Demonstrations and Industry Approaches	AEA Technologies DDFA Projects	25
CH15C251	Facility Characterization	Portable X-Ray, K-Edge Heavy-metal Detector	29
NV05C253	Facility Characterization	Airborne and Ground-Based Laser-Induced Fluorescence	—
DE-AC21-93 MC30176	Facility Characterization	Three-Dimensional Integrated Characterization and Archiving System	30
DE-AR26-98 FT 40365	Facility Characterization	Fast Response Isotopic Alpha Continuous Emissions Monitor	31
DE-AR21-94 MC30359	Facility Characterization	Laser Ablation of contaminants from Concrete and Metal Surfaces	—
DE-AR26-98 FT 40367	Facility Decontamination	High Productivity Vacuum Blasting System	32
DE-AC21-93 MC30170	Facility Dismantlement and Material Disposition	Advanced Technologies for Decontamination and Conversion of Scrap Metal	—
DE-AR21-93 MC30362	Facility Dismantlement and Material Disposition	Asbestos Pipe-Insulation Removal System BOA	33
Multiple Projects	Facility Dismantlement and Material Disposition	Robotics Crosscutting Program	34
DE-AC21-93 MC30179	Worker Safety/Other	Protective Clothing Based on Permselective Membrane and Carbon Adsorption	36
DE-AR26-97 FT34314	Worker Safety/Other	Robot Task Space Analyzer	37
FT06IP01	Worker Safety/Other	Integrated D&D Decision Analysis Tool	38
DE-AR26-98	Worker Safety/Other	Modular Manipulator for Robotic Applications	39

2.1 Demonstration and Industry Approaches

Crates of plutonium-contaminated gloveboxes stored at Los Alamos National Laboratory (LANL) are destined for permanent disposal at the Waste Isolation Pilot Plant (WIPP)

LANL TRU Waste Characterization, Decontamination and Disposition LSDDP

Objective and Scope: The Los Alamos National Laboratory (LANL) TRU Waste Characterization, Decontamination and Disposition Large Scale Demonstration and Deployment Project (LSDDP) addresses the characterization, decontamination and volume reduction of oversized metallic transuranically contaminated (TRU) waste currently in storage at LANL's storage and disposal area, TA-54. The LANL LSDDP reflects the cooperative interest of industry, government, and academia to bring collaborative expertise and strength to DOE's TRU decontamination and decommissioning program at LANL and elsewhere within the DOE complex. LANL currently has 1,500 m^3 of TRU waste in inventory—313 plutonium-contaminated gloveboxes in a 24,000 ft^2 facility—and expects to generate another 2,500 m^3 from ongoing operations in coming years.

The major objectives of this LSDDP are to:

- Identify technologies that are ready for deployment for the characterization, decontamination and volume reduction of TRU waste/TRU contaminated metallic objects
- Identify technologies that are ready for demonstration
- Demonstrate those technologies with potential to reduce cost, risk and schedule and that are amenable for direct field application at Los Alamos and elsewhere in the DOE complex
- To the extent possible, compare technologies "side by side" with baseline approaches to evaluate their advantages (cost, risk, schedule) and refine/validate baseline assumptions
- Capitalize on the combined corporate management and technical strength of private industry, government and academia
- Demonstrate a leveraged funding pool of federal and private monies via cost sharing to address issues of national importance
- Provide ready access to demonstration results through an aggressive communication program

Status and Accomplishments: The LANL LSDDP has demonstrated the following five technologies to date: the AeroGo air pallets, the SAIC Vehicle and Cargo Inspection System (VACIS) for RTR of crates, the Mobile Characterization Services transportable X-Ray for RTR of crates, the Nukem RASP for sectioning gloveboxes, and the Mega-Tech hydraulic cutter.

The LANL LSDDP facilities in TA-54 were unaffected by the Los Alamos fire. However, the fire shifted priorities for both DOE and U.S. Army Corp of Engineers.

Current Activities: The DDFA provided the Integrated Contractor (IC) Team with the list of D&D technology sources from abstracts for Spectrum 2000. Several technologies were discussed as possible demonstrations to meet seven LANL LSDDP needs. New technologies included:

- a colormetric detector for lead for field screening
- Cygnus electrochemical decontamination

- Xstream data collection system

The NTvision technology was approved for demonstration. NTvision will keep a digital video record of items placed into WIPP containers. The unique aspect of this technology is its ability to electronically subtract before and after images over a specific time period.

For more information:

http://www-emtd.lanl.gov/LSDDP/DDtech.html

OST/TMS ID 2203

Jim Orban, DOE-Albuquerque
505–845–4421
jorban@doeal.gov

Steve Bossart, DOE-NETL
304–285–4643
steven.bossart@netl.doe.gov

Mound Tritium D&D LSDDP

Objective and Scope: The Mound Plant in Miamisburg, Ohio began operations in 1948. The site's mission, originally to fabricate the neutron initiator for the atomic bomb, expanded to include research, development, and production of numerous nuclear and non-nuclear weapons components, production of radioisotopically fueled thermoelectric generators and surveillance of nuclear weapons components.

The objective of the Mound Tritium D&D LSDDP is to identify, demonstrate and evaluate innovative technologies applicable to the decontamination and decommissioning (D&D) of tritium facilities. D&D of Mound's surplus tritium facilities, the T and R/SW Buildings, provides a unique opportunity to compare, evaluate, and eventually execute innovative D&D technologies alongside baseline technologies in an ongoing project. The Mound LSDDP will identify and explore methods to improve worker safety while achieving cost and schedule savings. The project is expected to identify technologies that, when implemented in the Mound LSDDP, will produce significant savings on the $57.8 million baseline. The results and successes of this demonstration project will benefit similar DOE facilities and projects.

The Mound Plant, Miamisburg, Ohio commenced operation in 1948.

The Technical (T) Building is an underground reinforced-concrete structure built in 1948 for the purification of polonium-210 used in nuclear weapons initiators. Later the facility was used to extract other radionuclides, house the plutonium verification facility, and store TRU materials. Facilities large enough to handle multikilogram quantities of tritium were added to the building. Current plans are to decontaminate T Building potentially allowing unrestricted public reuse by the year 2003. The SW Complex and one corridor of rooms in the adjacent R Building form the SW/R Complex. Four types of operations have been performed in these facilities to support nuclear weapons programs using tritium: component development, component evaluation operations, tritium recovery, and material analysis. To meet DOE's vision of completing the environmental restoration of the site by 2005, the SW/R Tritium Facilities will be demolished, and contamination beneath the building will be removed.

It is anticipated that innovative technologies will be applied to the following decontamination tasks:

- tritium-contaminated gloveboxes
- tritium characterization techniques
- productivity improvement technologies
- tritium specialties decontamination
- piping system removal and disposition
- mixed waste treatment and disposal
- tritiated water treatment
- contaminated water plume under SW building
- miscellaneous rad/non-rad traditional building materials disposition

The Mound LSDDP IC Team includes Babcock & Wilcox of Ohio, Lawrence Livermore National Laboratory (LLNL), British Nuclear Fuels Limited (BNFL), Foster Wheeler, IT Corp, LANL, Westinghouse Savannah River, Princeton Plasma Physics Laboratory (PPPL) and FIU.

Status and Accomplishments: Completed Demonstrations:

1. ***Portable Scintillation Counter (OST/TMS ID 2311):*** The Lumi-Scint portable scintillation counter is a portable, single-tube liquid scintillation counter that can be set to respond to the low-energy beta radiation from tritium. It uses a single photomultiplier tube and manual sample chamber. The Lumi-Scint can be run from an internal battery or 110 VAC for its operation. The unit can be obtained with a printer, which allows hard copies of its electronically stored data.
2. ***Water Solidification (OST/TMS ID 2312):*** This technology uses polymer-based absorbent (Waterworks SP-400) that can be used to solidify aqueous waste. It is similar to other polymer-based absorbents that offer benefits over traditional solidification agents such as cement or the Mound facility baseline solidification agent Aquaset. Benefits include a high liquid-to-absorbent ratio; no mechanical mixing required to promote the absorption process; little to no volume increase in the waste form after addition of the absorbent; and a very high retention in the form of the gel-like material.
3. ***Oil Solidification (OST/TMS ID 2313):*** This contaminated oil solidification technology, NOCHAR Petrobond®, is a high-quality polymer offered by NOCHAR®, Inc., of Indianapolis, Indiana, and is specifically designed as a petroleum-based liquid absorbent. The Petrobond® absorbs very quickly with little increase in volume. The Petrobond® can be used for free-liquid control in storage, transport, and disposal of low-level radioactive waste.
4. ***Tritium Clean-Up Cart (OST/TMS ID 2974):*** The Tritium Clean-Up Cart is a portable tritium Processing System Clean-Up Cart. Used as a stand-alone cart for scrubbing tritium effluent, it provides a scrubbing process based on catalytic oxidation of tritium. Tritiated water is collected on removable molecular sieve dryers, which can be shipped as low level waste below the 1080 curie "Type A" limit. The unit provides a projected decontamination factor of greater than 1000, with a process flow rate of 45 l/min. Design features include: mole sieve dryer beds configured in series with moisture monitors to prevent moisture breakthrough; process flow controllers in the main plumbing loop and air inlet system; process thermocouples, which provide process stream and enclosure over-temperature control; and an enclosure that can function as a ventilated hood during normal operating conditions, but can be isolated when tritium concentrations inside the enclosure exceed the pre-selected control setpoint.

The Tritium Clean-Up Cart was demonstrated as part of the Mound LSDDP

5. ***Pipe Cutting and Crimping System (OST/TMS ID 2955):*** The Pipe Cutting and Crimping System is a small hand-held, battery operated crimping tool manufactured by Burndy Products. This tool utilizes a separate hydraulic pump with a high-pressure hose connected from the pump to the crimping head. U-shaped dies are contained in the head for crimping. A battery-powered hydraulic pump or electric-powered pump can be used to develop 10,000 psi of pressure to the crimping head. A total of 30 crimping operations can be performed before recharging is needed. The small dimension and light weight make this tool very suitable for crimping in tight quarters.

Current Reporting Period Activities: During the current quarter, the Mound Tritium D&D LSDDP has finalized two technology demonstrations, the ENTHRALL® Heavy Metals Precipitator, and Self-

Assembled Monolayers on Mesoporous Support (SAMMS) Heavy Metals Adsorbent. These demonstrations are now expected to occur in mid-July. ENTHRALL® is a non-hazardous inorganic sulfide designed to stabilize heavy metals present in fluids, sludge, soil, and other media. Its primary active ingredient is calcium sulfide. ENTHRALL® would be added to Mound's existing containers of tritiated oil, with minimal mixing, to precipitate heavy metals and to generate a waste form (sludge) suitable for disposal at a low-level waste disposal site. The SAMMS material has high flexibility in that it binds with different forms of mercury, including metallic, inorganic, organic, charged, and neutral compounds. It removes mercury from both organic wastes, such as pump oils, and from aqueous wastes. Mercury-loaded SAMMS also has a good long-term durability as a waste form because of the following: (1) The covalent binding between mercury and SAMMS has good resistance in ion-exchange, oxidation, and hydrolysis over a wide pH range; and (2) the uniform and small pore size of the mesoporous silica prevents bacteria from solubilizing the bound mercury. The SAMMS material would be added to existing containers of tritiated oil and thoroughly mixed to adsorb the heavy metals in the oil. A filtering phase removes the SAMMS material with adsorbed heavy metals, in a filter cake waste form (sludge), suitable for disposal. The remaining tritiated oil can then by solidified for free-liquid control in storage and transport and for subsequent disposal of radioactive waste oils, as a non-mixed waste.

Also during the current quarter, the Mound Tritium D&D LSDDP conducted another successful Ohio Sludge Initiative deployment of NOCHAR Petrobond® oil solidification technology at Sandia National Laboratory (SNL) in Albuquerque, NM. SNL in the past had tried to incinerate oil wastes at the INEEL Waste Effluent Remediation Facility without much success because of the cost and waste ash that was sent back. There are currently more than thirty-five 20-gallon containers of mixed-waste oils with varying amounts of tritium contamination in SNL's inventory. It is estimated that it would cost SNL about $1.5 million to incinerate the oils at INEEL. TCLP results of the small quantity of waste volume treated during the deployment are expected to pass the requirements of the disposal site. If deployed for all of the waste volumes at SNL, NOCHAR® will cost about $250,000 resulting in a savings of about $1.25 million. The Savannah River Site (SRS) has also expressed interest in deploying the NOCHAR® technology for treatment of highly contaminated Purex solvent stored in tanks.

For more information:

http://www.doe-md.gov/lsdd/lsdd.htm

OST/TMS ID 2201

Mark Mintz, Principal Investigator, LLNL
925–422–8394
mintz1@llnl.gov

Don Krause, Project Mgr., BWXT Services
937–865–4501
kraudr@doe-md.gov

Harold Shoemaker, DOE-NETL
304–285–4715
harold.shoemaker@netl.doe.gov

▼INEEL Fuel Storage Canals and Associated Facilities D&D LSDDP

Objective and Scope: The Idaho National Engineering and Environmental Laboratory (INEEL) Fuel Storage Canals and Associated Facilities LSDDP is led by an IC Team consisting of Parsons Engineering, BNFL, BBWI, TLG Engineering, FIU, and Idaho State University. This LSDDP will utilize funding, technologies, and expertise from the Offices of Environmental Restoration, Science and Technology, and Nuclear Material and Facility Stabilization; industry; universities; and the international community.

The project includes the following areas:

- *Test Reactor Area TRA-660,* housing two underwater research reactors, the Advanced Reactor Measurement Facility and the Coupled Fast Reactivity Measurement Facility, with a 30,000-gal interconnecting water canal that was sometimes used for fuel storage. These facilities were utilized for reactivity insertion experiments that were later scaled up for experiment design

in larger reactors. The two reactors achieved criticality in 1960 and 1962, respectively. Neither has operated since February 1991. Contamination includes radioactive elements, lead, and chromium.

- *TRA Filter Pit system*, consisting of five structures containing large filters associated with test reactor operations. The facilities are contaminated with lead, radioisotopes, and deteriorating asbestos. The filters are located in restricted entry pits, and D&D work will have to be done remotely and in confined spaces.
- *Test Area North TAN-620 Initial Engine Test Control Room*, a massive underground, shielded, heavily reinforced concrete structure that served as the control center for the engine tests in the Aircraft Nuclear Propulsion Program conducted at the INEEL in the late 1950s and 1960s. Contamination includes asbestos, mercury, lead, and some potential radiation.

This LSDDP is a high priority for the DOE/Commercial Nuclear Utilities D&D Consortium, with demonstrated technologies having deployment opportunities in the nuclear utility market through the consortium. Resulting deployments throughout the DOE complex alone could generate a potential cost savings and mortgage reduction of $20 million.

Eleven to 18 innovative and improved technologies will be demonstrated in the areas of underwater inspection, characterization, and dismantlement; inspection, characterization, and dismantlement in restricted spaces; recycle of materials from D&D activities; removal of loose radiological contamination on walls, floors, piping, and equipment; removal of fixed radiological contamination on concrete; tank, vessel, and piping decontamination; lead plate radiological decontamination; and high-radiation exposure fields.

Current Reporting Period Activities: The PCB Analyzer, Paint Scaler and Lead Paint Analyzer, which were previously demonstrated, were deployed on a number of occasions during the period. These screening tools allow INEEL D&D Operations to make immediate determinations for dispositioning rooms and facilities, rather than wait the typical 30-90 days for conventional laboratory results. The En-Vac robotic wall scabbler demonstration that began at TAN 607 Decon Shop in March was immediately deployed at the TAN North Gallery. The demonstrations and deployments were completed by April 4, 2000. The Global Positioning Radiometric Scanner (GPRS) system, which was demonstrated in a previous reporting period, was deployed, twice at TAN 3XN in early April 2000. The Surveillance and Monitoring System (SAMS) was demonstrated in late March and was immediately deployed to check soil at TAN OU-26 on April 14, 2000, and again at Test Area North in May 2000. The SAMS demonstration satisfied the LSDDP milestone to complete field demonstration of a cumulative total of 11 new/innovative technologies under full-scale conditions by April 4, 2000. The In Situ Underwater Gamma Spectrometer (ISUGS) demonstration was completed on May 25, 2000. This was the thirteenth demonstration completed at the INEEL LSDDP.

The IC Team is currently working with DOE and the Research and Development Institute of Construction Technology (NIKIMT) in Moscow, Russia, to demonstrate a Russian technology. The technology is a non-tethered 3D-Gamma Locator Device (GLD) that provides three-dimensional characterization of radioactivity in areas of high levels of radioactivity. It is a robotic unit that provides results to a computer-based control system. The first phase testing of the technology was successfully accomplished, during an earlier period, in Russia. Work is proceeding to bring this technology, with an isotopic analyzer, to the INEEL for demonstration.

For more information:

http://id.inel.gov/lsddp/

OST/TMS ID 2202

Andy Mikkola, DOE-ID
208–526–0725
mikkolaw@inel.gov

Dick Meservey, INEEL-BBWI
208–526–1834
rhm@inel.gov

Steve Bossart, DOE-NETL
304–285–4643
steven.bossart@netl.doe.gov

Canyon Disposition Initiative

Objective and Scope: The Hanford Canyon Disposition Initiative (CDI) Project was initially a collaborative project that included participation across the DOE Office of Environmental Management (EM). Participating EM offices included the Offices of Waste Management Environmental Restoration, Science and Technology, and Nuclear Material and Facility Stabilization. This partnership was driven by the broad and significant impact that decisions made on the disposition of the canyons would have to all of these programs. Due to a recent reorganization of EM on September 1, 1999, CDI is being overseen by the newly created Office of Project Completion.

The CDI Project is evaluating the feasibility of using the five chemical processing facilities (canyons) as assets for disposal of low-level wastes, instead of a mortgage liability. The U Plant facility is being used as a pilot for this evaluation. The DOE Richland Operations Office (RL) Environmental Restoration Program signed an Agreement in Principle with the regulators at the beginning of FY 1997, to conduct the evaluation for the disposition alternatives for the canyon facilities. In 1996, a Canyon Task Team of personnel from RL, the U.S. Environmental Protection Agency, and the Washington State Department of Ecology (known as the Tri-Parties) conducted a series of workshops to identify an approach for the long-term disposition of the five main processing facilities in the 200 Area (B Plant, T Plant, U Plant, the Plutonium Uranium Extraction Facility and the Reduction Oxidation Plant) at the Hanford Site. The assessment made by the Canyon Task Team centered on the possibilities of removing the processing facilities, leaving all or part of the facilities in place and identifying alternative beneficial uses for the facilities. The team concluded that the technical approach for dispositioning any of the facilities could be bounded by the following seven alternatives:

Alternative 0:
No Action

Alternative 1:
Full Removal and Disposal

Alternative 2:
Decontaminate and Leave in Place

Alternative 3:
Entombment with Internal Waste Disposal

Alternative 4:
Entombment with Internal/External Waste Disposal

Alternative 5:
Close in-Place—Standing Structure

Alternative 6:
Close in-Place—Collapsed Structure

The Record of Decision for the 221-U Facility will generate regulatory and technical precedence for future disposition of the other four remaining processing facilities.

Current Reporting Period Activities: Preparation of the survey plan for the structural assessments, including the ventilation tunnel, was completed. The concrete coring unit has been procured and received at the site. The concrete coring unit will be used to obtain samples to support the structural assessments and to determine whether or not potential contaminants have migrated beyond the confines of the cells. The concrete sampling requires the use of the railroad tunnel roll-up door to provide access to both the railroad tunnel and the cells. The repair of the roll-up door was initiated and completed during the period. The cover blocks of the railroad tunnel were placed to support the repair and to provide for placement of the Remote Concrete Coring System (Brokk 150N with concrete coring attachment) in the facility. The concrete coring system has completed acceptance testing and is scheduled for deployment in late July 2000.

The crane was used to support the roll-up door repair and is being used for process cell inspections (e.g., Cells 23, 26, 27, 29, and 30).

Plans have been developed for the inspection of the canyon facility 24-inch drainpipe.

A remote crawler and support equipment have been procured and are being configured and tested. A video that was taken from the outfall of the drain line showed a vertical rod blocking the drain line. Further research into the facility records showed that conductivity probes might be inserted through the drains in up to 10 cells. The probe(s) have lifting bails and should be easily removed, if accessible by the crane.

For more information:

http://bhi-erc.com/canyon/canyon.htm

OST/TMS ID 2178

Kim Koegler, BHI
509–372–9294
Kjkoele@bhi-erc.com

John Sands, DOE-Richland
509–372–2282
john_p_sands@rl.gov

John Duda, DOE-NETL
304–285–4217
john.duda@netl.doe.gov

Highly Selective Nuclide Removal System—Accelerated Site Technology Deployment

Objective and Scope: In 1992, the last of the five U.S. Department of Energy production reactors at SRS was placed into shutdown mode, with no intention to restart. With this action, the site entered an extensive deactivation and long-term surveillance and maintenance life-cycle phase. The integrity of the aging facilities has become a concern in recent years. Large volumes of contaminated water exist at some of these facilities at SRS (for example, fuel storage and disassembly basins). Treatment of this water requires removal of the water from the basin and shipment to the F and H Area Effluent Treatment Facility (ETF). A technology that is cost-effective and safe is needed to process the basin waters on location and selectively remove radioactive materials without transporting the water to ETF. The technology must reduce targeted nuclides to near DOE release limits and condition the water for direct release. Efforts to address these concerns have been initiated under the current funding for reactor monitoring and are being incorporated into the overall facility deactivation, decontamination, and decommissioning planning strategy. With the uncertainty of the basin integrity over time, a technology that can remove radioactive contamination from the basin water while minimizing secondary waste generation is essential to the success of the deactivation of the DOE reactor basins. The SRS ASTD will deploy an innovative, highly effective water treatment system to remove selected radionuclides (both strontium and cesium) from millions of gallons of water. Overall, deactivation and decommissioning life-cycle costs are expected to be significantly lowered via deployment of the technology.

Status and Accomplishments: 3M's Selective Separation Cartridge™ (SSC) was readied for deployment at the SRS R-Basin. Lead shielding installation on the SSC system was completed in the middle of March, and the SSC system was transported to the R-Basin for deployment.

Current Reporting Period Activities: 3M's water cleanup system commenced operation at the R-Reactor disassembly basin in the beginning of May. It is initially being operated with the 3M SSC to selectively remove strontium (Sr-90) and then cesium (Cs-137) from the 5 million gallons of water in the disassembly basin. Two sets of SSCs have been separately deployed to determine which set is better at selectively removing Sr-90. Approximately 14,000 gallons were run through the first set and approximately 12,000 gallons through the second set. The Sr-90 filters were supposed to be selective for Sr-90, but they did remove a small amount of Cs-137. The second set of filters performed quite differently than the first set. They absorbed much less cesium (Cs-137) than the initial set, and then started to desorb the Cs-137 after about four hours of operation. The liquid samples will now be analyzed to determine radionuclide removal efficiency.

Cartridges for the selective removal of Cs-137 will be deployed next. The operation of the SSC technology will then be operated in parallel with the Graver/Selion water treatment technology for approximately 6-8 months to bring cesium and strontium contaminant levels down to near release limits.

For more information:

OST/TMS ID 2937

John Pickett
Westinghouse Savannah River Company
803–725–3838
john.picket@srs.gov

John Duda, DOE-NETL
304–285–4217
john.duda@netl.doe.gov

Mobile Work Platform—Accelerated Site Technology Deployment

Objective and Scope: This ASTD project involves a partnership between the Fernald Environmental Management Project (FEMP) and Idaho National Environmental and Engineering Laboratory (INEEL) to purchase and deploy a Mobile Work Platform (MWP) at Fernald and the INEEL and potentially at other DOE Sites including Hanford, Rocky Flats and the Savannah River Site.

Five major complexes, Plants 7, 4, 1, Boiler, and 9, at the FEMP site have been successfully decontaminated and decommissioned (D&D) during the course of ongoing environmental restoration activities pursuant to the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). Major complexes, Plant 2, Plant 8, and the Pilot Plant, will undergo D&D activities in FY 2001 and FY 2002. In addition to the FEMP facilities, the INEEL Test Area North - Building 616 has also been identified as a deployment location.

To address the sites' needs, Fernald and the INEEL will develop a common specification and then purchase a MWP that satisfies both sites' needs.

Status and Accomplishments: While the FEMP achieved cost and schedule improvements with each successive D&D project, D&D of the major projects was expensive and labor intensive. Of particular concern during past, present and future D&D projects is the removal of "process" piping. Removal of process piping presents two concerns. The first is a personnel safety concern. The workers, impaired by several layers of personal protective clothing and a full-face respirator, have to handle power tools while working off the ground on ladders, scaffolding and/or man-lifts. The second concern is the close proximity, within inches, that the workers have to be to a radiation/contamination source (process piping). This concern has been formally documented at FEMP by the Site Technology Coordination Group (STCG), Need Number OH-F010, "Safe and Efficient Process Piping and Conduit Dismantlement." This is the highest priority of Fernald's documented D&D needs. Use of a MWP will remove the workers from the immediate industrial hazard and radiation/contamination zone, which will significantly increase the safety of the pipe/conduit removal process.

A Deployment Plan has been written and issued. Detailed requirements and specifications are being developed. Operator training and initial deployment will be completed by the end of FY 2000.

Current Reporting Period Activities: No significant activities to report this quarter.

For more information:

OST/TMS ID 2243

Larry Stebbins, Fluor Daniel Fernald
513–648–4785
Larry.Stebbins@fernald.gov

Jane Powell, NETL
304–285–4687
jane.powell@netl.doe.gov

Remote Size Reduction for Large Hot Cell Deactivation—Accelerated Site Technology Deployment

Objective and Scope: The 324 Building, located at the Hanford Site near Richland, Washington, is being deactivated to meet state and federal cleanup commitments. The 324 Building has several highly radioactive tanks, tank vaults, piping and large hot cells containing complex chemical processing equipment. To meet the cleanup commitments, there is a need to deploy more rapid and remote size-reduction, debris collection and removal, characterization and decontamination methods. Readily deployable deactivation methods that reduce worker exposure, secondary waste generation, costs, and risks are also needed. Deployment of a remote/robot work platform in the 324 B-Cell with full reach capabilities will significantly accelerate work tasks, eliminate the need for multiple, specialized tool design and procurement and reduce the overall program risks.

The Hanford Site ASTD project will fund the deployment of a robot work platform to support 324 B-Cell cleanup activities. Through this project, Hanford will procure and deploy a remote/robot work platform that is positioned with an overhead crane to perform deactivation activities. Following B-Cell cleanup, the work platform will be deployable for other 324 and Hanford site cleanup missions.

Status and Accomplishments: The French firm Cyberneteix was awarded the contract for the remote/robotic platform that will be deployed at the 324 facility hot cells. The remote/robotic platform will help facilitate rapid remote size reduction, debris collection and removal, characterization and decontamination operations to enhance deactivation of the hot cell complex to meet state and federal cleanup requirements. Deployment of the new system will reduce worker exposure, secondary waste generation, cost, and risk. Current baseline operations utilize overhead cranes and mechanical manipulator systems.

Current Reporting Period Activities: Design and fabrication of the remote robotic platform is underway. This system is expected to be delivered to Hanford in late August.

For more information:

Ernest Bitten – BWHC
509–376–0709
ernest_j_earnie_bitten@rl.gov

John Duda, DOE-NETL
304–285–4217
john.duda@netl.doe.gov

Surface Contamination Monitor—Accelerated Site Technology Deployment

Objective and Scope: The objective and scope of this Nevada Test Site (NTS) ASTD project is to deploy a Surface Contamination Monitor and Survey Information Management System (SCM/SIMS) from Shonka Research Associates (SRA). The SCM/SIMS will be deployed at the Test Cell C facility, which was used for testing nuclear rocket reactors. The facility has a large exterior concrete pad and interior floor spacing requiring survey. The SCM/SIMS will be used for the radiological characterization of concrete floors in order to expedite survey and closure at a reduced cost and risk. Use of SCM/SIMS is expected to be extremely beneficial in characterizing the Test Cell C facility, and is expected to be deployed at other NTS facilities including the Pluto facility.

Status and Accomplishments: Over 3700 square meters were surveyed using the SCM/SIMS. Surveying productivity was more than an order of magnitude greater for the SCM/SIMS, and the total cost was several times less than the baseline technology. Initial SCM/SIMS deployment at NTS was completed early in FY 2000. The NTS is discussing/negotiating the use (acceptance) of SCM/SIMS with Nevada regulators, as the new baseline for clearance surveys across the site. The DDFA will promote the successful NTS deployments of the SCM/SIMS throughout the DOE, to support additional deployments and commensurate cost savings.

Current Reporting Period Activities: The final Cost and Performance Report for the SCM/SIMS was delivered. It will be published and distributed throughout DOE. The SCM/SIMS resulted in a 35-fold improvement in survey efficiency, and a cost

reduction of 29% to 40% compared to the baseline method of characterization.

For more information:

Clayton Barrow, DOE-Nevada
702–295–7960
barrow@nv.doe.gov

Mark Distefano, IT Corp.
702–295–2191
mdistefa_it@nv.doe.gov

John Duda, DOE-NETL
304–285–4217
john.duda@netl.doe.gov

Oversize Transuranic (TRU) Waste Laser Cutting System at the Nevada Test Site—Accelerated Site Technology Deployment

Objective and Scope: DOE Nevada has a need to size-reduce and characterize 58 oversized TRU-contaminated metal boxes (total volume of 270 cubic meters) prior to shipping them to WIPP. The contents of these boxes are contaminated gloveboxes (32), a metal cutting lathe, lengths of metal piping, lengths of angle iron and various scrap metals. The Hanford material requiring size reduction includes a minimum of 150 gloveboxes (there are also ductwork and piping). At Rocky Flats, the laser cutting system will also be applied to contaminated gloveboxes (150).

Status and Accomplishments: The laser and chiller and trailer were purchased, and were stored at the trailer installation vendor's site. The laser cutting equipment is expected to be installed at the LANL DVRS building site in November 2000, with full-scale operation beginning around April 2001.

Current Reporting Period Activities: FY 2000 funds have been received by LANL and Fluor Hanford (FH) and work is progressing. The laser, chiller, and trailer were purchased in April and assembly started in May. The robotic arm and the cutting control station, ABB Model 6400 were selected. LANL and FH are working with the end users, LANL and possibly Hanford, to define the specific requirements for mounting the unit; for example, air pallet or rail system. The equipment resides at the Physical Sciences Laboratory of New Mexico State University. The rotational cutting table has been eliminated from the system, and there will be only a single robotic arm to hold the laser end effector.

The Oversize Transuranic Waste Laser Cutting equipment from GSI Lumonics is used in ASTD to diminish the size of TRU waste to fit into WIPP containers.

In late June, assembly work continued on the laser cutting system. The installation of the laser, chiller, and cutting control station in the trailer is expected to be completed in July 2000. The control station contains the controllers and monitors for the laser and robotic arm. The next step will be the integrating of the laser and the robotic arm at the Lumonics facilities in Minnesota. This is expected to occur in late August 2000.

The latest deployment schedule shows the laser cutting equipment being installed at the LANL DVRS building site in November 2000, with full-scale operation beginning in April 2001. The DVRS building site at LANL was not directly impacted by the fire. However, the fire may have caused a resorting of project priorities at the DVRS location site.

Rocky Flats personnel had expressed interest in laser cutting. The application would be to the decontamination and decommissioning of Building 707. They were interested in the specifics of this project's laser cutting system. They are also interested in attending the system testing at Lumonics or at Hanford. The situation at Rocky Flats is that there are large pieces of equipment that need to be reduced; and there is much concern about the ability to cut thick metal, especially cast iron. If they move forward, the Rocky Flats group would like to install a laser cutting system by the spring of 2001. They want to complete the D&D of Building 707 by 2005.

For more information:

Dave Hippensteel, DOE-NV
702–295–1467
hippensteel@nv.doe.gov

Harold Shoemaker, DOE-NETL
304–285–4715
harold.shoemaker@netl.doe.gov

Personal Ice Cooling System (PICS)—Accelerated Site Technology Deployment

Objective and Scope: The objective of the Personal Ice Cooling System (PICS) (OST/TMS ID 1898) is to control the heat stress of workers. This project is designed to deploy the PICS personal protective equipment to Fernald's workforce as well as to other DOE sites. Fernald will also implement administrative and educational programs designed to overcome cultural barriers and replace the existing baseline with the PICS. PICS is a self-contained core body temperature control system that uses ordinary ice as a coolant and circulates cool water through tubing that is incorporated into a durable and comfortable, full-body garment (pants, shirt, and hood). Water is frozen in bottles that are worn outside/inside of Anti-Cs in a sealed, insulated bag with a circulating pump attached to a support harness system. An adjustable-rate, battery-powered pump circulates the chilled water through the tubing in the suit. The adjustable pump allows the worker to control his temperature based upon his workload, unlike "ice vests" where the initial cooling is often extreme and uncomfortable. The ice bottle, pump, and suit make up only 12 pounds, a relatively small load. This effort provides the project team with nearly 100 PICS units as well as several central chillers and all required support equipment. The team will deploy various PICS systems (the three-piece [hood, shirt, and pants] suits and/or vests) to each of ten additional DOE sites by a team of Fernald labor-union personnel. This team will conduct proactive workshops on the PICS and its benefits to the workforces at ten other DOE sites (Nevada Test Site, Hanford, Oak Ridge, Paducah, Savannah River, Rocky Flats, Pantex, Los Alamos, Sandia, and Mound). It is envisioned that the educational workshops coupled with leaving "seed" PICS systems will create a demand for the PICS at the other DOE sites. This approach to widespread deployment using experienced workforce personnel is similar to the successful approach Fernald used to achieve widespread deployment of the oxy-gasoline torch. Not only will Fernald see the cost savings realized by using the PICS, but other DOE sites will as well.

Status and Accomplishments: As of May 2000, the Fernald team has deployed 96 PICS cool suit systems to 13 DOE sites through this ASTD project. Based on conservative estimates for their use across these 13 sites, the cost savings are estimated at around $750K per year. The results were derived using a conservative estimate of savings for the 13 DOE complex sites (Nevada Test Site, Hanford, Oak Ridge, Paducah, Savannah River Site, Sandia, Los Alamos, Pantex, Rocky Flats, Mound, Fernald, Lawrence Livermore National Laboratory, and Carlsbad)

Current Reporting Period Activities:

During the current period, the project deployed 10 PICS cool suit systems and provided the associated training to the DOE Carlsbad, New Mexico. During this same time period, two of these PICS cool suit systems were deployed and the appropriate training on the proper use/care of the suits provided to each of the Fire Departments at Nogales, Arizona (March 1); Laredo, Texas (March 3); and El Paso, Texas (March 23). These deployments are part of the DOE-Carlsbad sponsored U.S.-Mexico Border Region Technology Deployment Initiative for Hazardous Wastes. During early May, the Fernald team deployed 10 PICS cool suit systems and three oxy-gasoline torches at the Volpentest Hazardous Materials Management and Emergency Response (HAMMER) Training and Education Center. Located in Richland, Washington, the

HAMMER Training and Education Center emphasizes a hands-on approach to train personnel performing work at the DOE Hanford Site. The HAMMER personnel train over 3,000 workers each year. The hands-on philosophy at the HAMMER fits completely with the DOE-FEMP approach to the deployment of the PICS cool suits and oxy-gasoline torches. The Fernald team trained over 20 leading instructors at the HAMMER facility in the proper use and care of the PICS cool suits and the oxy-gasoline torches. The Fernald team deployed two PICS cool suit systems (and possibly one oxy-gasoline torch) and provided the training on the proper use/care of the suits at the Portsmouth Gaseous Diffusion Plant on June 19. They also deployed two PICS cool suit systems and provided the associated training at the Ashtabula Environmental Management Project on June 20.

For more information:

Marty Prochaska, Fluor Daniel Fernald
513–648–4089
marty.prochaska@fernald.gov

Harold Shoemaker, DOE-NETL
304–285–4715
harold.shoemaker@netl.doe.gov

Integrated Decontamination & Decommissioning-Accelerated Site Technology Deployment

Objective and Scope: The overall objective of the Integrated Decontamination and Decommissioning (ID&D) ASTD project is to increase the use of innovative/improved but proven technologies on a large scale in the D&D of facilities in the DOE weapons complex. The reason for increasing the use of these innovative/improved technologies is that each has demonstrated improvements over current baseline methods in cost, schedule, waste generation, radiation exposure, or safety. Increased use on a large scale will be accomplished by doing actual D&D projects with the selected innovative/improved technologies, thereby increasing user familiarity and experience with them and adding them to the array of tools available for D&D projects. The technologies added to the D&D toolbox have all been proven on a smaller scale, either through demonstration in the DDFA's LSDDPs or through commercial use, but they have not been used to decontaminate and decommission facilities across the DOE complex. After completing the ID&D ASTD project, the DOE expects to see increased use of these technologies that will result in ongoing cost savings at the INEEL, FEMP, Argonne National Laboratory-East (ANL-E), and other sites in the DOE complex. The ID&D ASTD project will provide for implementation and deployment of a suite of 12 D&D technologies. These technologies will be deployed at over 20 deployment sites (facilities) at the INEEL, FEMP, and ANL-E. The anticipated technologies included: oxy-gasoline torch; track-mounted shear; hand-held shear; GammaCam; BROKK 250 demolition robot; Decontamination, Decommissioning, and Remediation Optimal Planning System (DDROPS); soft-sided containers; snap-together scaffolding; concrete crusher; Personal Ice Cooling System (PICS); lead paint analyzer; and alloy analyzer.

Status and Accomplishments: During the project, the FEMP project team performed D&D on nine facilities 3F, 3G, 8F, 22A, 24B, 38A, 38B, 39C, and 45B and dismantled and demolished them utilizing the oxy-gasoline torch (OST/TMS ID 1847), hand-held shear (OST/TMS ID 2304), and track-mounted shear-crusher (OST/TMS ID 2303) technologies. At the INEEL, the following technologies were deployed in some 11 facilities to date: Oxy-gasoline Torch (OST/TMS ID 1847); GammaCam™ Radiation Imaging System (OST/TMS ID 1840); Remote Control Concrete Demolition System (OST/TMS ID 2100); Decontamination, Decommissioning and Remediation Optimal Positioning System (DDROPS) (OST/TMS ID 2322); Soft-Sided Waste Containers (OST/TMS ID 2240), EXCEL Automatic Locking Scaffold (OST/TMS ID 2320), Personal Ice Cooling System (PICS, OST/TMS ID 1898), Lead Paint Analyzer (OST/TMS ID 2317), PCB Analyzer

(OST/TMS ID 2398), and Paint Scaler (OST/TMS ID 2952). During the project, the Argonne-East team deployed a Remote Control Concrete Demolition System for the demolition of the CP-5 reactor bioshield; they also used the oxy-gasoline torch for cutting reinforcing bars in the concrete and other metals in the reactor service area.

Current Reporting Period Activities: During the current period, additional INEEL deployments of the Lead Paint Analyzer, PCB Analyzer, and Paint Scaler continued during April at the Chemical Processing Plant 603, Central Facilities Area 690, Old Fire Station, and Security Training Facility.

For more information:

http://id.inel.gov/idd

Dick Meservey, INEEL
208–526–1834
rhm@inel.gov

Harold Shoemaker, DOE-NETL
304–285–4715
harold.shoemaker@netl.doe.gov

▼Release of Concrete for Recycle from Decontamination and Decommissioning Projects—Accelerated Site Technology Deployment

Objective and Scope: While most of the concrete waste generated during D&D activities is not contaminated, some portions are contaminated with radioactive or chemical constituents. Because of the difficulties and uncertainties associated with the unrestricted release of concrete, much of the uncontaminated concrete is treated as though it were contaminated and is disposed as low-level radioactive waste. Even concrete that is shown to be uncontaminated is either disposed of in a sanitary landfill, or is used as backfill. Disposal at a radioactive or sanitary waste site can be costly and eliminates the opportunity to economically recycle or reuse the concrete.

The INEEL ASTD project, in collaboration with ANL-E, will develop and test a protocol for the free release of concrete. The protocol, to be developed by the ANL-E, will follow the ten basic steps for free release outlined in DOE Order 5400.5, and will be modeled after the protocol for the free release of scrap metal previously developed by the ANL-E. In short, the protocol will be a decision tree that takes into account factors such as the type and level of contamination; volume47 and type of concrete; stakeholder and public approval; and the cost of decontamination. Based on this

The concrete crusher being loaded with concrete debris.

information, the protocol will outline possible disposition alternatives for the concrete and their relative costs. The protocol will be applicable across the DOE complex. Once the protocol is written, it will be applied to a test case at the INEEL to assist with planning D&D of a facility. The protocols will then be shared with others within the DOE complex so that it can then be applied on a complex-wide basis to reduce the cost of D&D operations involving concrete removal by allowing for re-use of concrete that meets EPA regulations and DOE orders.

Although many relatively small facilities have previously been decommissioned at the INEEL, many large facilities await decommissioning. Facilities such as the Engineering Test Reactor (ETR), Materials Test Reactor (MTR), Power Burst Facility (PBF), and a variety of waste handling and laboratory facilities will be decommissioned over the next several years. Each of these facilities contains massive amounts of concrete, which represents tremendous savings potential if it can be re-used. The amount of contaminated concrete at the INEEL is estimated to be as low as 278,000 ft^3 and as high as 354,000 ft^3, while the non-contaminated concrete (including that in the landfill) is estimate at 7.7 million ft^3.

Status and Accomplishments: The preliminary draft of the Protocol for the Re-use of Concrete was received from the ANL-E on February 29 and reviewed by the INEEL team. The Central Facilities Area (CFA) Sewage Treatment Plant was chosen as a test case for the new protocol. Information to support the protocol was sent to the ANL-E, including INEEL procedures and data on the CFA Sewage Treatment Plant concrete volumes, contaminants, facility and process descriptions and disposition methods chosen. In addition, a summary of common concrete cleaning methods with their capital and operational costs and throughput rates was provided.

Current Reporting Period Activities: No significant activities to report this period.

For more information:

Dick Meservey, INEEL - BBWI
208–526–1834
rhm@inel.gov

Jane Powell, NETL
304–285–4687
jane.powell@netl.doe.gov

▼Deployment of Innovative Characterization Technologies and Implementation of the MARSSIM Process at Radiologically Contaminated Sites—Accelerated Site Technology Deployment

Objective and Scope: One of the most significant issues facing planners of D&D projects is the cost associated with characterization of the facility. There is uncertainty concerning the amount of data that needs to be collected and the level of analysis required in all phases of a D&D project, from the initial planning phase through the closure phase. These uncertainties make it difficult to define the full scope of a project at the outset and to prepare, with confidence, a feasible D&D schedule. This ASTD project plans to address some of the most important issues associated with facility characterization through the implementation of the guidelines contained in the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM). Additionally, this ASTD project will augment the MARSSIM process through deployment of innovative in situ characterization technologies. This effort focuses on the characterization of the Brookhaven Graphite Research Reactor (BGRR), which is currently undergoing stabilization in preparation for near-term D&D.

Status and Accomplishments: To date, the focus of MARSSIM, a regulatory guidance document developed collaboratively between DoD, DOE, EPA, and the Nuclear Regulatory Commission (NRC), has been for final status surveys used in determining if a remediated site/facility meets the applicable release criteria. The application of the MARSSIM process at the BGRR facility for initial investigation prior to remediation of decommissioning activities represents one of the first applications of this kind within the DOE complex.

Utilizing MARSSIM, coupled with the in situ measurement technologies the In Situ Object Counting System (ISOCS, OST/TMS ID 2098) and BetaScint Fiber-Optic Sensor (OST/TMS ID 70) have been used to conduct characterization of the BGRR facility and surrounding soils. The ISOCS has characterized above-ground ducts, Fan House 5 and the Pile Fan Sump including excavated soil analysis. Real-time analysis of approximately 600 soil samples was conducted over a four-week period. The ISOCS has provided an estimated cost saving of $150,000 over the baseline laboratory analysis and accelerated schedules by two months. Soil analysis was conducted using the BetaScint for strontium-90 and uranium-238. Using this near real-time technique, sample analysis ranged from $35 to $60 per sample compared to laboratory analysis, which takes one to four weeks at a cost of $200 to $300 per sample.

Current Reporting Period Activities: No significant activities to report this period.

For more information:

OST/TMS ID 2374

Paul Kalb, BNL
516–344–7644
kalb@bnl.gov

Steve Bossart, DOE-NETL
304–285–4643
steven.bossart@netl.doe.gove.gov

Deactivation & Decommissioning (D&D) Consortium

Objective and Scope: In December 1997, DOE signed a Memorandum of Understanding (MOU) with the Electric Power Research Institute (EPRI) and several nuclear utilities to jointly develop and deploy new D&D technologies. DOE's objective is to expand the reach of benefits of the "leading-edge" technologies being deployed within the DOE nuclear complex. The MOU Consortium established a charter in early 1998 and identified challenging technological areas common to both DOE and the commercial industry. Both DOE and commercial sites will be used for these demonstrations and deployments.

DOE and EPRI are collaborating to conduct quarterly workshops at various nuclear plants around the country, each focusing on a particular decommissioning area. DOE and the utilities present the most recent, innovative technologies to improve productivity and worker safety while reducing cost. The workshops will solicit feedback from hands-on plant managers and field workers. Topics covered to date address low-level waste disposal, concrete decontamination, imbedded pipe decontamination, and site characterization.

Status and Accomplishments: The first technology demonstration resulting from the DOE/EPRI/Utility Consortium was completed at the Rancho Seco Nuclear Power Plant.

The first technology demonstration involved the concrete shaving technology developed by Marcrist Industries, Ltd. Two separate pieces of equipment were demonstrated. Both used a diamond-impregnated shaving drum as the cutting tool for removal of the concrete surface. Generated dust was collected by a vacuum system and deposited in a waste drum.

The first piece of equipment was a self-propelled, electric powered floor shaver. It was demonstrated on clean and radioactively contaminated floor areas in the reactor turbine building. Several parameters were recorded as part of the demonstration and the technology was well accepted by the operating staff.

The second piece was a hydraulically powered wall-shaving unit. For purposes of the demonstration, the unit was mounted on a forklift.

Current Reporting Period Activities: The efforts supporting the DOE/EPRI/Utility Consortium during the past quarter concentrated on the execution of the second technology demonstration at the Rancho Seco Nuclear Power Plant. This demonstration involved the shot blast concrete cleaning system with an integrated in-line radiation measuring system under development at FIU-HCET. The draft technology report for the concrete shaving technology demonstrated in March was also circulated for review and comment.

The second Rancho Seco demonstration involved the FIU-HCET-developed in-line measurement system integrated onto a shot-blast concrete cleaning machine. The system provided a rapid way to decontaminate concrete floors when surface and near surface contamination is present. The measurement system allowed the machine operator to observe the contamination removal by watching the computer readout mounted on the machine.

The third demonstration being planned will be a demonstration of the FIU-HCET Integrated Vertical and Overhead Decontamination System (IVOD) technology to clean concrete walls and ceilings. The technology involves the use of concrete shaving technology attached to a surface walking robotic device. The in-line measuring system is also built into the machine. The robotic climber uses vacuum to hold itself to the surface. This technology will be demonstrated at Rancho Seco during August.

For more information:

Nelson Rekos, DOE-NETL
304–285–4066
nelson.rekos@netl.doe.gov

Florida International University

The Deactivation and Decommissioning (D&D) Technology Assessment Program (TAP) was developed to provide detailed, comparable data for environmental technologies and to disseminate this data to D&D professionals in a manner that will facilitate the review and selection of technologies to perform deactivation and decommissioning.

Significant events for this reporting period

- Framatome Technologies demonstrated their plasma arc cutter, hydraulic shears, and power-chipping hammers on an empty glovebox and an annular tank. Size reduction of a kynar tank was removed from the Framatome Scope of Work due to the composition of the tank's lining material being unsuitable for plasma arc cutting. All external lead layers from the surrogates were removed manually by application of a power-chipping hammer prior to size reduction. In keeping with the lead compliance program in place for these size reduction demonstrations, routine air samples were collected throughout the demonstration to quantify size and distribution of airborne particulates.
- RubbleMakers™ demonstrated the Brokk 250 demolition equipment with hydraulic shear and scabbler attachments at FIU-HCET on April 10–14, 2000. The targets of the demonstration were dismantlement of various metal structural members and coating removal from a concrete ceiling, wall, and floor as well as a brick wall. The Brokk 250 with a hydraulic shear removed I-beams, a 6" pipe, railings, and two barricades but failed to remove a larger overhead I-beam and a 12" cast iron pipe. The scabbler successfully removed coatings from a concrete floor and wall but had problems with the brick wall. Instead of removing only the coating, it actually fractured the bricks. A technology evaluation report is being prepared and will be published in the June project progress report after the vendor's review.
- NUKEM Nuclear Technologies/DETEC demonstrated its Remotely Operated Advanced Segmentation Process (RASP) in the size reduction of a glove box and an annular tank on May 1–23, 2000. Airborne lead emissions were measured during the demonstration. Nukem is using a gel belt to control particulates during cutting. Ongoing demonstration of Nukem's wire saw to size reduce glove boxes and tanks was being witnessed by personnel from Rocky Flats and proceeded nicely.
- Testing of the IVOD system has begun. This system was recently built by FIU-HCET and RedZone as part of the grant with NETL. It is being tested for aggressive surface removal on concrete floor, wall, and ceiling.
- Demonstration of ex-situ pipe decontamination system at Big Rock Point is proceeding and should conclude by July 7, 2000. Pipe is fed into the unit where it is characterized and decontaminated on both the exterior and interior of the pipe with grit blasting. Pipe is being fed into the unit with increasingly levels of contamination. Current contamination levels on the pipe are 100,000 dpm/100 cm^2.

The search for facility dismantlement technologies for building materials continues. Currently seven additional, potential technologies have been identified.

- Concrete cutting tools
- TARGET—Concrete saws
- Concrete Cutting & Breaking, Inc.—Remotely Operated Vehicles (ROV)
- Controlled Demolition, Inc.—Explosive Technology
- KENT DEMOLITION TOOLS—Hammers, air rams, booms, and air tools
- Universal Impact Technologies, Inc.—Bulldozing
- D&L Thomas Equipment Corporation—BETONAMIT, Non-explosive demolition agent

For more information:

HCET homepage: http://www.hcet.fiu.edu/

M. A. Ebadian, FIU HCET
305–348–3585

Paul Hart, DOE-NETL
304–285–4358
paul.hart@netl.doe.gov

▼AEA Technology DDFA Projects

The DOE engaged AEA Technology, through an International Agreement, to bring a UK perspective to U.S. decommissioning activities within the DOE-complex. AEA's contributions are broad in nature and include planning as well as specific technology contributions.

Demonstration and Deployment of Soft Media Decontamination Techniques for Various Applications at the Savannah River Site:

Introduction: DOE has a large inventory of contaminated lead currently stored throughout the complex with more being added as DOE and its contractors decontaminate and decommission facilities. For example, SRS currently has 200 to 300 tons of stored lead that must be decontaminated in an efficient, cost-effective manner. ANL and INEEL also have a similar problem and have expressed a need to identify a cost-effective and reliable technology with a proven track record to decontaminate lead prior to final disposal. AEA has extensive experience in designing, building and operating pliant media blast systems in high-radiation environments, particularly in the commercial nuclear sector.

Although pliant media decontamination is not a new technology; it has not been extensively demonstrated or deployed in the DOE complex for these applications. In this project, AEA will use its commercial deployment experience to perform a hot demonstration of lead brick decontamination at SRS. Demonstrating the effectiveness of the sponge blasting system is expected to lead to future deployments throughout the complex. SRS has also expressed a need for a decontamination technology for contaminated tank riser plugs and pump transport vessels. In addition to performing the hot decontamination demonstration on contaminated lead bricks, AEA will demonstrate the effectiveness of the pliant media blast system on a contaminated tank riser plug. During the operation phase of these demonstrations, AEA will train Savannah River staff on proper procedures for decontaminating these components using a sponge blasting system.

Current Status and Accomplishments: The sponge blast demonstration/deployment April 10 at SRS was initially put on hold due to excessive noise associated with the blast nozzle. Solutions were investigated, including the use of a "noise cancellation headset." Industrial Health staff at SRS addressed the noise issues. AEA returned to the SRS on June 5 to finish the demonstration of soft pliant media decontamination of lead bricks and riser plugs.

Demonstration and Deployment of a Passive Ventilation Device for D&D Activities at the Savannah River Site.

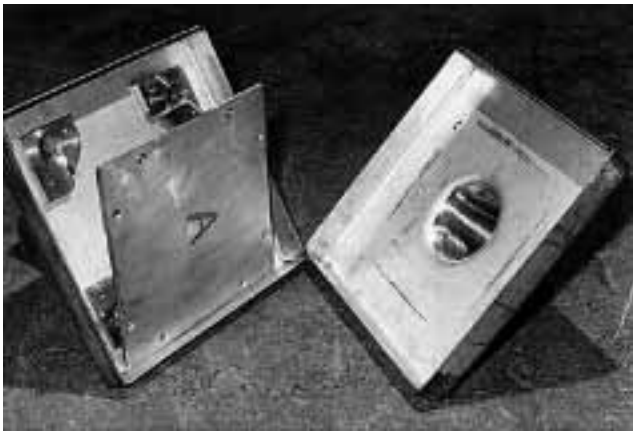
Ventilation control has classically been conducted using a pressure sensor, controller, valve actuator, and mechanical air-regulating valve to vary the flow of air and the depression in a system. Should the dynamics of the system under control vary, there is a finite time for the mechanical system to adjust while the signal from the pressure sensor travels to the controller as it opens or closes the mechanical valve to regulate the flow. The system is always lagging behind what is happening in the unit under control, and under certain conditions this can be detrimental to operations and/or hazardous to workers.

To overcome this situation in the UK, AEA developed a non-mechanical, part passive ventilation valve that responds instantaneously to the behavior of the system. This device, known as a Vortex Amplifier or VXA, has no moving parts and is maintenance free. It is able to react instantaneously to pressure variations in a system, and is therefore inherently more reliable and more efficient than conventional pressure equalizing systems. The scope of this PTP is to design, fabricate, and demonstrate two vortex amplifiers for separate applications at the SRS, offering a reliable, proven alternative with a better track record as compared to conventional mechanical systems.

Inspection, Sampling, and Remediation Options for Tank 105 in the HLW Vault in Building 324 at Hanford:

Introduction: To date, the DOE complex has primarily focused on closing large radioactive tanks and decontaminating and decommissioning smaller, low-level radioactive tanks at the various sites. In the coming years, several high-profile projects that involve highly radioactive waste tanks will need to be inspected, characterized, emptied and then dismantled, will commence. Due to the significant radiation dose and costs associated with these activities, an innovative, integrated approach to these activities is needed, which will deliver significant benefits in terms of increased safety, reduced costs, and shortened schedules.

As part of the overall decommissioning plan at the Hanford site, it is planned to



Vortex Amplifier or VXA, has no moving parts and is maintenance free.

close Building 324. One of the major projects involved in closing this building is the removal and disposal of four tanks in the high-level waste vault located beneath the hot cells in the building. These tanks, T104, T105, T106, and T107 are of the classic "Idaho" design and have limited access with all pipes having fully welded connections. Preparatory work needed for the removal of the tanks would include removal of piping and ductwork connections.

The purpose of this project is to conduct a feasibility study to examine several key aspects of the preparatory work leading to the temporary use and eventual D&D and removal of Tank 105. The principal stages of this process are envisioned to be:

- Inspection—
  deployment of a visual/imaging system into the tank to view the internals
- Radiation monitoring—
  to get an accurate radiation measurement
- Sampling—
  retrieval and analysis of a sample of waste to determine composition
- Decontamination—
  removal of the tank waste contents

Current Status and Accomplishments: Started assembling the mock-up of the Tank 105 (at Hanford's 324 Building) characterization/access system. Demonstration of the mock up is expected to occur in the next quarter.

Demonstration of Tension Diamond Wire Cutting System for the Cutting of Complex Steel Components, Including Components with Extensive Internal Voidage:

An alternative system to wrap-around diamond wire systems has been used in the UK for the size-reduction of large, hollow steel components in radioactive environments. This method is to tension the diamond wire on a frame, and then to use the wire in a similar manner as a band saw. As the length of the wire remains fixed for the duration of the cut, adjustments to the wire tension and feed of the wire can be carried out remotely. Also, continuous wires can be used, thus eliminating the crimp connector that is used to join the ends of the wire for the wrap around systems. Failure of the crimp joint is a major cause of wire breakage during cutting.

Through this PTP, AEA will undertake a series of demonstration cuts using a tensioned diamond wire system to cut large, heavy-walled steel components. The components selected will be representative of items that are routinely encountered within the DOE complex, and will evaluate key technical and cost savings aspects of this cold cutting technique.

Current Status and Accomplishments: The DDFA has brokered discussions between AEA and the INEEL for the development of a work package in which large thick-walled reactor components would be size reduced, using the tension diamond wire technique. The DDFA also brokered discussions between AEA and Hanford site representatives that focus on the K3 ducts at WESF.

For more information:

Mark Morgan, AEA Technology
703–433–0720
morgan@aeatech.com

Raschig Rings at RFETS:

Introduction: The Rocky Flats Environmental Technology Site (RFETS) in Colorado contains nine major plutonium process buildings as well as 60 or more uranium and radioactive waste storage buildings. All of the buildings are slotted for eventual demolition as stated in the site closure plan. Aggressive projects are underway to decommission the facilities at the site in time to meet the 2006 milestone.

Four of the buildings used directly in the plutonium production process house storage tanks with an inventory of raschig rings and sludge, which are used to control criticality. The raschig rings and sludge are required to be removed from the tanks as part of the deactivation activities taking place. The current method utilized to decommission tanks containing raschig rings requires building an enclosure around the tank and manually opening the tank. The raschig rings are then removed by shoveling or raking the rings into a separate container. These procedures expose workers to high levels of risk and result in high levels of airborne contaminants. Currently, the site is considering an alternative using fixative coatings to reduce the amount of airborne contamination. A system capable of retrieving the sludge and managing the criticality has yet to be identified.

Site Need DD07 entitled "Improved Disposition of Raschig Rings" calls for a more robust method of raschig ring and sludge recovery.

The project proposes to create a conceptual design to remove the raschig rings and sludge from the tanks during deactivation activities. The design will consider techniques to mitigate the worker exposure risks. This is a major concern of the current system.

Contribution to the Development of an Options Study to Decontaminate Exhaust Ducting in Building 324 at Hanford:

Introduction: The DOE has accelerated the Decommissioning and Dismantlement Schedule of the facilities in the 300 Area at the Hanford Reservation site in Richland, Washington. As part of the overall decommissioning plan at the Hanford site, it is planned to deactivate Building 324. One of the major projects involved in deactivating this building is the decontamination of the exhaust ductwork from the Radiochemical Engineering Cells (REC). To achieve this task, project managers will evaluate the most effective technologies and processes in terms of worker safety, cost effectiveness, track record, and schedule acceleration.

AEA will assist the Building 324 project representatives in developing an Options Study to characterize and decontaminate the ductwork in the facility with particular interest on the B Cell exhaust duct. The Options Study will identify suitable alternatives to achieve the project goals, which could be demonstrated as part of future scopes of work to determine the most beneficial program for DOE. AEA Technology representatives will review technologies and processes which have been deployed in other nuclear facilities in Europe and the United States for characterizing and decontaminated ductwork.

Current Status and Accomplishments: The DDFA received, reviewed, and finalized with AEA and Hanford a Project Technical Plan for review of options for characterizing and decontaminating the complex duct system in the 324 facility at Hanford. AEA staff met with Building 324 managers on April 12 and 13 to discuss ventilation duct decommissioning options.

For more information:

Mark Morgan, AEA Technology
703–433–0720
morgan@aeatech.com

John Duda, DOE-NETL
304–285–4217
john.duda@netl.doe.gov

2.2 Facility Characterization

Portable X-Ray K-Edge Heavy Metal Detector

Objective and Scope: Ames Laboratory and Iowa State University's Center of Nondestructive Evaluation are developing an improved nondestructive assay (NDA) technique for detecting and quantifying uranium, plutonium and other heavy metals. The work is focused on situations where these materials are located inside sealed containers or processing equipment. The approach this technology uses is based on observing the K-edge absorption transition in x-ray transmission measurements. This technique is being developed to maximize the sensitivity for detecting heavy metals while minimizing the measurement time.

A project study showed that the K-edge heavy-metal detection technique would be beneficial for many D&D projects, especially those involving gaseous diffusion plants. Its use could have the biggest impact in inspecting the vast amount of piping in the plants. This inspection could be done in situ to allow monitoring of chemical flushing. The high sensitivity of the technique can be used to minimize the danger of contamination to workers and equipment during disassembly operations, resulting in savings of time and money in addition to reducing generation of waste.

Status and Accomplishments: During the first year of the project, FY 1994, the sensitivity of the technique was determined through modeling and laboratory demonstrations, ending with a design of a portable system. In FY 1995 and FY 1996, a prototype portable K-edge, heavy-metal detector was assembled and tested in the laboratory. This system consisted of a high-flux x-ray generator, a collimator for minimizing the local radiation hazard and providing the requisite beam characteristics, a monochromator, a real-time imaging detector for simplified alignment, and an energy-dispersive detector for collection of the K-edge data. The equipment, including the x-ray generator and detectors, is controlled by a personal computer. The same PC analyzes the raw data, with the result being made available to field personnel. Sensitivity comparable to the original laboratory tests was achieved, and measurement time was reduced by a factor of two. A 2-mm layer of uranium was successfully measured through 1 inch of steel. The K-edge system analyzed thorium contamination in seven drain lines in Wilhelm Hall. Minimal contamination was found in two lines, significant thorium contamination in three lines, mercury contamination in one line, and one case of a drain trap contaminated with uranium, thorium, and mercury. This was the first true in situ demonstration of the K-edge system. The K-edge system was subsequently demonstrated in the Savannah River Site LSDDP to measure the amount of highly enriched uranium (HEU) in the rooftop ventilation ducts for the Machining Room lathes. Sixty-six wide-angle images and 66 narrow beam spectroscopic shots were made during the demonstration. Approximately 84 feet of ventilation duct were assayed. When gram quantities were found, the precision was in the ±3 percent range. About one quarter of the narrow beam measurements identified a significant amount of HEU. An ITSR is available from the Savannah River Site LSDDP demonstration titled a "*Portable X-Ray K-Edge Heavy Metal Detector*," April 2000 (DOE-EM-0519).

Current Reporting Period Activities: No activities to report this quarter.

For more information:

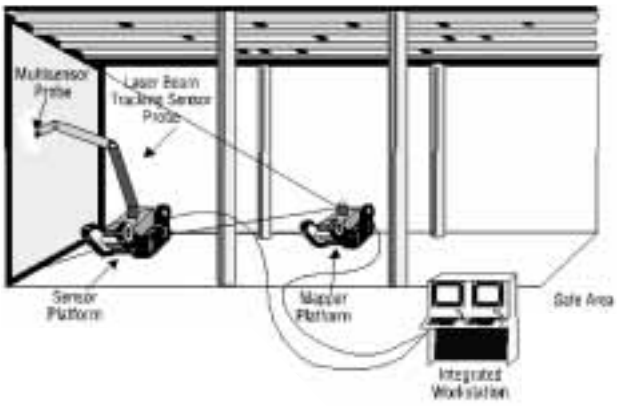
OST/TMS ID 134

Joe Gray or Terry Jensen
Ames Lab/
Center of Nondestructive Evaluation
515–294–9745
tjensen@cnde.iastate.edu

Charles Nalezny, DOE-HQ
301–903–1742
charles.nalezny@em.doe.gov

The K-edge technology is effective even through 1-inch-thick steel.

Three-Dimensional Integrated Characterization and Archiving System (3D-ICAS)



Three-Dimensional Integrated Characterization and Archiving System (3-D ICAS) is a remote mapper and sensor platform to use in contaminated areas.

Objective and Scope: Coleman Research Corporation (Coleman) will develop a remote system that can rapidly analyze in situ hazardous organic and radionuclide contaminants on structural materials. This remote system is the Three-Dimensional Integrated Characterization and Archiving System (3D-ICAS). The 3D-ICAS consists of a mobile sensor platform and a mobile mapper platform that operate in contaminated areas, and an integrated workstation that remains in a safe location. Development of this technology will occur in three phases.

Status and Accomplishments: The 3D-ICAS was successfully integrated with mobile platforms at Oak Ridge National Laboratory. The Coherent Laser Radar Mapper was operated on the OmniMate robotic platform and the contaminant analysis units and robot arm carrying the multisensor probe head were integrated on the overhead transporter. The system was subsequently demonstrated at Oak Ridge National Laboratory, Robotics and Process Systems Division in October 1998. The demonstration was conducted in the hi-bay area using a wall unit specially constructed for the demonstration. The wall unit consisted of pieces of cement-based wallboard and a small piece of an asbestos-containing material. The wall unit was purposely contaminated with low-levels of organic materials, alpha emitters, and a beta emitter. The demonstration consisted of mapping the wall unit, displaying the map, selecting points to be surveyed, running the contaminant survey which required moving the sensor/analysis unit with the transporter and acquiring the sensor unit with the 3D mapper, displaying the measured contamination in real time, and displaying detailed spatial and contamination data after the survey was completed. An unfortunate hardware failure the morning of the day before the demonstration prohibited acquisition of contaminant data from the high-speed gas chromatography/mass spectrometry (HSGC/MS) and only the Molecular Vibrational Spectrometer (MVS) provided real-time identification of the substrate material during the demonstration. This was a significant success since the MVS correctly identified the wallboard as being cement even though the particular substrate sample had not been included in the system's neural network training set. Failure of the HSGC/MS was unfortunate, but its performance had been well documented and demonstrated prior to the demonstration at ORNL and it did not detract from the main objective of the demonstration, which was to show end-to-end system operation with the 3D-ICAS mounted on ORNL mobile platforms. The GC/MS was shipped back to Thermedics and they are in the process of replacing the parts and recalibrating the system. When complete the system will be shipped to the DOE Environmental Measurements Laboratory in New York City for the validation testing.

Current Reporting Period Activities: 3D-ICAS will be demonstrated at Florida International University (FIU). The purpose of this demonstration is to show the operation of the system mounted on the mobility platform. The platform conveys the coherent laser range mapper, sensing robot arm subsystem, contaminant analysis unit, and multi-sensor probe. The discussions between Coleman Research Corporation and FIU personnel on the schedule, test plan, and other issues are ongoing.

For more information:

OST/TMS ID 97

Ray Ross
Coleman Research Corporation
703–719–9200
ray_ross@mail.crc.com

Vijendra Kothari, DOE-NETL
304–285–4579
vijendra.kothari@netl.doe.gov

Fast Response Isotopic Alpha Continuous Emissions Monitor

Objective and Scope: The objective of this effort is to develop and test Continuous Air and Emission Monitoring (CAEM) instrumentation for alpha-emitting radionuclides. This instrument will be designed in order to certify the proper performance of airborne emissions from ambient air and in equipment emissions encountered during D&D of DOE's surplus facilities. The proposed system will also meet the DOE's alpha CAEM requirements through the development of an innovative, high-resolution, on-line air/gas alpha monitor. The instruments will be capable of operating either as a stack emissions monitor, a process control instrument, or for the control of off-gas from decontamination, dismantlement, and air handling equipment.

Initial efforts will be focused on the development and evaluation of a rapid alpha-counting-based instrument to monitor ambient air and emissions to meet the monitoring and equipment control needs of surplus facilities undergoing decontamination and decommissioning. This development will establish the feasibility of a prototype instrument for use in detecting radionuclides that are present, or create susceptibility to exposure, throughout the DOE complex. The prototype instrument will be tested under the supervision of DOE's Inhalation Toxicology Research Institute in Albuquerque, New Mexico. Based on the prototype results efforts may be continued to full-scale commercial prototype for demonstration in one of DDFA's LSDDPs.

Informal meetings were held with various DOE CAEM end users. For example, the personnel associated with LANL's upgrade of their continuous air monitoring system for the Plutonium Facility at Technical Area 55 (TA-55) continue to be very interested in the further development of the Fast-Response CAEM. LANL was interested in hosting the Phase II field test in their back yard, at the LANL TA-54 LSDDP.

Current Reporting Period Activities: Thermo Power will expand base phase work to include a field demonstration at the LSDDP. Results indicate that the instrument is capable of detecting alpha radiation in air samples at a concentration orders of magnitude lower than the current continuous emissions monitors available, while providing results in a matter of minutes. Additional work will be added in a modification to the base phase in order to support a field test of the first prototype instrument in conjunction with the LSDDP at Los Alamos National Laboratory.

For more information:

OST/TMS ID 2225

Thermo Power Corp. (Tecogen Division)
Keith Patch
617–622–1022
patch@tecogen.com

Richard Bush, DOE-NETL
412–386–6426
bush@netl.doe.gov

2.3 Facility Decontamination

High Productivity Vacuum Blasting System

Objective and Scope: The objective of this project is to improve the productivity and economics of existing vacuum blasting technology, which is used to remove radioactive contamination, PCB's, and lead-based paint and provides worker protection by continuously recycling the material and dust from the decontamination tasks. This work will focus on re-designing and improving existing vacuum blasting components, including: blast head nozzles, ergonomic handling of the blast head by reducing its weight, brush-ring design, vacuum level regulator, efficiency of dust separator, and operational control sensors. The redesign is expected to enhance the productivity and economy of the vacuum blasting system by at least 50 percent of current vacuum blasting systems.

LTC Americas will develop the necessary mathematical models of air-particle flow in the nozzle, in the blast head and interface area, and in the dust separator to study the flow characteristics and interaction of the various elements of the system. The purpose of this model development is to increase the productivity and economy of existing vacuum blasting technology by 50 percent. Based on the results of this modeling effort, the contractor will experimentally test and verify that the above system components perform according to the mathematical simulations and complete the preliminary design of the components of the proposed system. This will include an overall configuration of the system including: material selection and testing, definition of the range of dimensional and weight parameters, conceptual arrangement or design of the blast head unit, and dust separator unit. Based on the prelim-inary design, the contractor will procure components, and perform fabrication and assembly of the proposed system.

The performance of the system will be evaluated in the laboratory mock-ups representing various clean-up situations and environments. The contractor will review, analyze, and interpret data collected from the tests and develop a productivity enhancement profile of the pre-prototype unit including economic analysis. Based on the laboratory test results, the contractor will modify, change, and make adjustments to enhance the capability of the system.

Status and Accomplishments: Phase I has been completed. In Phase I, mathematical models and related code to simulate the entire process numerically were developed. Based on the data from the model, an innovative rectangular nozzle and a new centrifugal separator were designed, manufactured, and tested. The tests were performed to verify the mathematical models. The numerical results agreed with the measured data with a deviation within 10 percent. Experimental results also showed that if the new inno-vative design rectangular nozzle replaces the old circular nozzle, more than a 50 percent increase in productivity efficiency could be achieved. The newly designed centrifugal separator offers a high-efficiency separation increase from about 30 to 75 percent, even using finer abrasives.

Phase II has been initiated. In Phase II, a pre-prototype of the nozzle, blast head with wind curtain, sensors and dust separator will be designed, constructed and tested to assess the performance of the new design under controlled conditions at the contractor's facility.

Current Reporting Period Activities: The Phase II pre-prototype was tested during the month of June at FIU. The results of tests are still pending however preliminary results indicate that the new rectangular nozzle, along with the other refinements made to the vacuum blasting system, substantially out performed the baseline circular nozzle.

For more information:

OST/TMS ID 2224

LTC Americas, Inc.
Williams McPhee
703–406–3005

David L. Schwartz, DOE-NETL
412–892–6298
schwartz@netl.doe.gov

2.4 Facility Dismantlement and Material Disposition

Asbestos Pipe Insulation Removal System (BOA)

Objective and Scope: Most of the steam and process piping in DOE facilities is clad and insulated with asbestos containing material (ACM), which must be removed before any decontamination and dismantling activities can occur. Manual removal is expensive and time consuming because of the carcinogenicity of asbestos fibers, radiological contamination and abatement regulations of the EPA and the Occupational Safety and Health Administration. Carnegie Mellon University (CMU) is developing and demonstrating a mechanical asbestos removal system that can be remotely operated without a containment area. This technology, known as BOA, is a pipe-crawling, asbestos-removal robot supported by a mobile, boom-vehicle robot that places the pipe-crawling robot and then seals and bags removed asbestos.

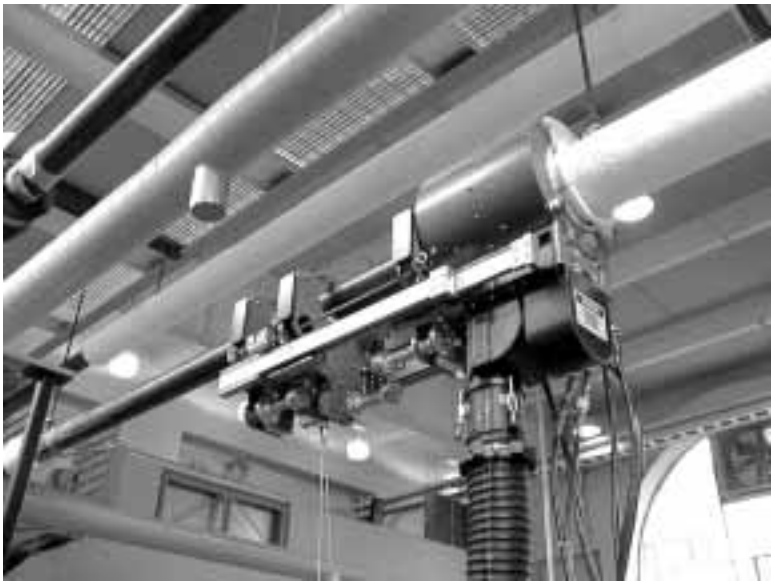
Development of the BOA technology will occur in two phases over a two-year period. Phase I will develop a prototype BOA pipe-crawler robot. Phase II will integrate the BOA pipe-crawler robot with the boom-vehicle robot.

Status and Accomplishments: Development of the prototype BOA pipe-crawler robot is complete. Laboratory demonstrations were completed at CMU and a field demonstration was completed at Oak Ridge in the back of K-1210 on the old K-25 site (now ETTP) in Oak Ridge, Tennessee. Air quality was independently monitored and found to be far below (by factors of 6 and 2, respectively) the EPA established limits of 0.1 fibers/cm^3 over an 8-h time-weighted average period and clearance samples below the maximum of 0.01 fibers/cm^3 for a 1500-L air sample. The two-operator scenario was demonstrated and shown to be workable, with all on-pipe and off-board logistics equipment essentially operating autonomously. During the field demonstration it became clear that it would be advantageous to harden certain features of the on-pipe system to allow it to work on the more prevalent 3-inch pipe at K-25 and Y-12.

The Asbestos Pipe Insulation Removal Robot System dubbed BOA, placed second in a national design competition hosted by the renowned Design News trade journal/ magazine. BOA was selected from a large number of national entries, and it was judged one of the most innovative new designs and products in the United States in 1997/1998. Based on the performance of a robot abating at a rate of 30 linear feet per hour, compared with about 3 to 6 feet in DOE/industry, with associated per-foot abatement cost ranging between $25 and $150 for DOE/Industry, it was determined that substantial savings could be realized with the use of such a robot system. Overall abatement costs could decrease between 25 and 50 percent depending on whether the system replaces a current glovebag or full containment method. The BOA system will assist DOE in reducing the cost of asbestos abatement as part of decontamination and dismantlement activities across the weapons complex.

The complete system was tested on long runs and hanger-passes for 3-inch diameter piping. The complete on-pipe abatement head and off-board logistics system was hardened through lengthy and exhaustive abatement runs, all of which were performed on lagged insulation and included many hangers. The abatement productivity and reliability was maintained and the viability of using the system on 3- and 4-inch diameter piping was certified. With this, the BOA system was ready for field-testing.

The BOA robot was delivered to the Pentagon Wedge 1 Renovation Project in late June 1999. The robot abated a total of 6 feet, while running into continual problems with a very thick canvas layer covering the insulation—the cutters continually wrapped and clogged



CMU's award-winning design for the Asbestos Pipe Insulation Removal Robot System dubbed BOA, is a pipe-crawling, asbestos-removal robot supported by a mobile, boom-vehicle

themselves with the canvas cloth, thereby, never being able to fully cut the insulation without continual manual clearing of the coverhead. Hence, the test was terminated because inspection of the BOA system revealed that it was totally immobilized and the CMU team could not readily repair it at the Pentagon. As a result, the BOA system was returned to Pittsburgh for repairs.

CMU has submitted a proposal to rectify the system for proper use in the future. The main activities to be accomplished are to bring the BOA system back into working condition and to focus on the rebuilding of BOA and testing with simulant material. After this, testing in an enclosure with wrap-and-cut sections of insulated piping system with real asbestos at an off-site contractor facility will occur. The rebuilding of BOA will include mechanical parts and some other failed components in the clamper and in the removal system and rewiring of the control-computer enclosure. Currently funding is not available to complete the effort. Additional funding to support the effort is being sought.

Current Reporting Period Activities: No activity to report.

For more information:

OST/TMS ID 148

Hagen Schempf
Carnegie Mellon University
412–268–6884
hagen+@cmu.edu

Vijendra Kothari, DOE-NETL
304–285–4579
vijendra.kothari@netl.doe.gov

Robotics Crosscutting Program

Objective and Scope: The Robotics Crosscutting Program (Rbx) supports the DDFA through technology development, close interaction with D&D Industry and University Programs funded through the National Energy Technology Laboratory (NETL) and introduction of new robotics technology into the DDFA's LSDDP. Overall emphasis of the program continues to be design and integration of remote systems and capabilities used for facility deactivation and ongoing surveillance and maintenance activities with extended application to final facility D&D tasks. Deployment of remote D&D systems will reduce worker exposure to hazardous environments and provide productivity increases leading to substantial cost savings.

Status and Accomplishments: The major focus for Rbx in FY 2000 has been on three initiatives started in FY 1999. The first initiative, in support of the INEEL D&D program, will develop a low-cost D&D system that integrates the compact remote operator console with the Brokk demolition system to provide remote viewing and tool control capabilities.

The second new Rbx initiative is the development of telerobotic control capabilities for remote systems. Telerobotic control provides computer control of system operations, reducing the workload of the operator and increasing system effectiveness through more efficient execution of many tasks. The primary candidate for heavy manipulation in D&D is the Schilling Titan class hydraulic manipulator. DOE expertise in hydraulic control and robotic control systems provides an opportunity to enhance the control for the Schilling manipulators to allow telerobotic operation of these systems.

The final Rbx initiative started is the development of telerobotic systems for D&D of below-grade structures and equipment. There are many below-grade equipment enclosures (pits) with overhead access. Examples of such equipment pits are the filter pits at the INEEL and the much more numerous riser pits associated with the underground storage tanks at Hanford. The process cells within the canyon facilities are further examples of this type of environment. Most of these facilities have radiation or contamination levels that require

remote operation for any characterization or D&D functions. These facilities represent target application sites for the telerobotic manipulation system based on the Schilling manipulator, the compact remote operator console and the telerobotic control capability.

Current Reporting Period Activities: INEEL Robotics staff have been working with site D&D operations manager to finalize schedules and plans for the deployment of the Modified Brokk Demolition Machine with Remote Console (OST/TMS ID 2938). Currently, two potential D&D activities have identified the need to utilize the Modified Brokk. Both projects have a tentative September start date.

Robotics staff have been addressing hardware and software compatibility issues associated with the Telerobotic Control (OST/TMS ID 2939) of the Schilling controller. Design has also started on a box beam mount for the two Schilling Titan-II manipulators. The design will be similar to the designed used for the two Schilling 7F manipulators on Rosie-C (Rosie-Chicago), which will be used in D&D of the Oak Ridge K1420 building. The beam will provide a rigid mount for the two manipulators at a fixed separation but will have no additional base degrees of freedom; however, it will permit easy mounting of the dual arm setup on either Rosie-O (Rosie-Ohio) or the rigid boom overhead transport located in the ORNL Robotics Technology Assessment Facility (RTAF). Initial mounting of the box beam and manipulators will be on a pedestal base in the ORNL D&D Robotics Laboratory. Finally, activities continued to integrate hardware and software for the Robot Task Space Analyzer (OST/TMS ID 2171) and Compact Remote Operator Console into the overall system design.

Robotics staff met with Bechtel Hanford, Inc., to discuss possible deployment in FY 2001 and FY 2002 of the Telerobotic Manipulation System (OST/TMS ID 2181) as part of the Canyon Disposition Initiative. Three additional facilities at Hanford have been identified with significant remote systems/robotics needs for which the manipulation system may be a candidate. These are the 233-S Plutonium Concentration Facility, the F Reactor Fuel Storage Basin, and the 224-B Plutonium Facility.

Hanford Canyon Facility

Recently the INEEL D&D robotics staff assisted D&D Operations in deploying the Remote Underwater Characterization System (RUCS) for visual and radiological characterization of the TRA Material Test Reactor (MTR) canal in TRA-603. RUCS (OST/TMS ID 2151) is a small, remotely operated submersible vehicle that serves multiple purposes in underwater D&D operations. During the MTR canal characterization, the RUCS vehicle became contaminated and was transferred permanently to the INEEL D&D Operations for general D&D use. This transfer of property is a significant indication of how well D&D Rbx-developed technology is being utilized and actually incorporated into common-use equipment for D&D operations. Another opportunity to use RUCS has been identified at the INEEL Power Burst Facility.

Through the International Program two Russian technologies have been identified for demonstration at the INEEL Fuel Storage Canal and Associated Facilities D&D LSDDP; a Gamma Locating Detector and the Isotopic Identification Instrument. The Rbx D&D Product Line will be supporting these demonstrations by integrating the Russian technologies onto a robotic deployment platform and by performing mockup testing.

For more information:

OST/TMS ID 921

Dennis C. Haley
Oak Ridge National Laboratory
423–576–4388
haleydc@ornl.gov

Linton Yarbrough, DOE-AL
505–845–6569
lyarbrough@doeal.gov

2.5 Worker Safety and Other Projects

Protective Clothing Based on Permselective Membrane

Objective and Scope: Membrane Technology and Research, Inc. (MTR) is developing and demonstrating improved protective clothing that provides protection equivalent to current garments, but is lighter weight to improve comfort and is breathable to allow water vapor to escape, therefore reducing heat stress. Improved protective clothing will be made of an innovative fabric that combines an ultrathin, permselective outer membrane. The outer membrane is extremely permeable to water vapor escaping from the wearer, but highly impermeable to hazardous compounds. Fabric properties will be optimized and prototype suits well tested during Phase I. In Phase II, 20-30 suits will be fabricated and used in a variety of extensive, comparative trials in the laboratory and at a nonhazardous site.

Status and Accomplishments: Development of fabric materials and laboratory tests on the fabric have been completed. In laboratory tests, water vapor transmission rates of 600-900 g/m^2/day have been measured through the fabric. This water vapor transmission rate is far superior to butyl rubber suits with a water vapor transmission rate of 0-10 g/m^2/day. Chemical vapor transmission rates have been equal to or lower than the fabrics of commercial suits.

Two rolls of the fabric were laminated by Uretek. One roll of fabric (90 m by 30 in.), MTR1, uses rip-stop nylon as both inner and outer layers, and the second roll (40 m by 30 in.), MTR2, uses the rip-stop nylon on the outside and a flexible, lightweight, nonwoven fabric on the inside. The prototype suits manufactured by Kappler Systems received the following tests by outside laboratories: chemical permeation, physical properties, sweating mannequin, and heat stress modeling. In general, the results are not as good as expected: although the fabrics do combine water permeability and reduced heat stress with chemical protection, neither the chemical permeation resistance nor the reduction in heat stress were as high as hoped. The economic analysis was updated based on this new data. The analysis shows that MTR1 provides the greatest benefits in productivity; however, the benefit does not appear to justify the higher cost of the suit made of this fabric. MTR2 fabric has less productivity benefit and a higher selling price, and so is less attractive than MTR1.

The Phase II permselective garment testing by the International Union of Operating Engineers (IUOE) was concluded in August 1999. The garments tested, for personnel comfort and well-being of the worker while performing work, were those assembled by MTR's potential commercialization partner from the permselective fabrics supplied by MTR, Tyvek, and non-breathable garments like Saranex. The garments were all full bodysuits with hoods (for comparison purposes), and contained a more spacious cut in the chest and waist/crotch area than other manufactured garments, and this was very noticeable and appreciated by the test personnel. This also helped the garments to be more durable. Examples of tasks performed include crawling through confined spaces, performing metal grinding, and loading and hauling material in a wheelbarrow. The MTR garments, in general, were as comfortable, with respect to heat-stress, as the Tyvek garments, and extremely so, over the non-breathable garments. The test personnel all had very good comments concerning the MTR garments.

An innovative fabric combines an ultrathin, permselective outer membrane with a sorptive inner layer.

Current Reporting Period Activities: The report documenting the results of the permselective garment testing conducted by IUOE is under preparation. It is expected in July.

For more information:

OST/TMS ID 95

Hans Wijmans, MTR, Inc.
650–328–2228, Ext. 188
wijmans@mtrinc.com

Harold Shoemaker, DOE-NETL
304–285–4715
harold.shoemaker@netl.doe.go

Robot Task Space Analyzer (RTSA)

Objective and Scope: The objective of this project is to develop, integrate and test a sensor and software system called the Robot Task Space Analyzer (RTSA), a tool that gives robot work system operators the ability to characterize the geometry of tasks to be performed. This geometrical data is necessary to allow selected robot tasks to be automated. The work is being accomplished by developing a combination of software, sensors and computing hardware that enhance the performance of robotic equipment used in typical environmental remediation and waste management projects.

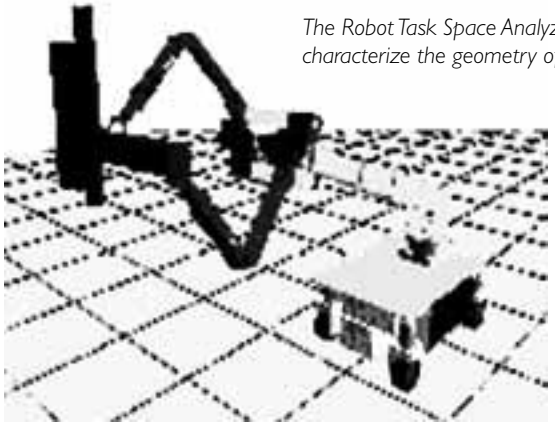
RTSA is an enabling technology necessary for the deployment of telerobotic automation in D&D. It is conservatively estimated that effective telerobotics systems can increase the productivity of D&D remote operations by 10 to 30 percent. If only 10 percent of the projected D&D projects involve remote operations, telerobotic savings enabled through the RTSA could be from tens to hundreds of millions of dollars.

The RTSA combines laser and stereo imaging, human-interactive modeling, and semiautomatic object recognition to build a 3-D model of the work zone in which a robot system is operating. In future telerobotic worksystems, RTSA results will be accessed by automatic collision checking and motion planning routines to automate subtask execution.

Status and Accomplishments: The goals of the first phase are accomplished. A comprehensive design that has emphasized human interaction and human factors engineering principles has been completed. RTSA is a human interactive system that allows a remote operator to direct the construction of 3-D geometrical descriptions of the task objects (e.g., pipes, valves, tanks, etc.).

A laboratory test demonstration was performed in September 1999. The key objective in the development of the RTSA was to use the earlier work in task space scene analysis as a foundation for the development of an in situ geometrical modeling system. This system is a practical tool that typical remote equipment operators could use comfortably. The test results show that the current RTSA design achieves this important goal. Initial time results indicated that RTSA has the ability to construct models of a task space scene analysis layer on the order of minutes. Future work will involve the implementation and detailed evaluation of a complete RTSA system. All of the program will be executed on PC workstations with Microsoft NT operating systems. Tests will be performed on several task mock-ups with multiple subjects and trials at the Remote Technology Assessment Facility at the ORNL. In addition, the RTSA system will be integrated with the Dual Arm Work Platform to achieve a comprehensive and working telerobotic system.

Current Reporting Period Activities: The University of Tennessee (UT) has developed a promising way to achieve increased remote work-system efficiency by layering telerobotic technologies onto



The Robot Task Space Analyzer will characterize the geometry of tasks for robots.

teleoperated remote systems. Robot Task Space Analyzer (RTSA) is an enabling technology necessary for the deployment of telerobotic automation in D&D. Automated dismantlement tasks involve reason-ing about the 3D structure of the world and planning the motion of robots and tools. It therefore requires quantitative position, size, and shape information about equipment to be dismantled and other objects surrounding it that the robot needs to be aware of. RTSA operates on the region of the world in which robotic dismantlement tasks are to be performed in the next several minutes.

Research and development of RTSA was conducted over two phases. In Phase I laboratory-scale components of RTSA were developed and evaluated. Phase II involved the implementation and detailed evaluation of a complete RTSA system. Phase II showed that the stereo and range autoscan procedures could successfully find parts in regions selected by the operator and the coordinates of the parts were derived and returned to RTSA.

A technical overview document was developed describing the philosophy, hardware, and software used and contains appendices that provide more technical detail about the autoscan procedures, error and part placement results, and use of LINUX as a real-time operating system. A functions and requirements document was also produced, which delineates the responsibilities of Carnegie Mellon University's (CMU) team and the desired functions of the finished RTSA code. This technology will be integrated with the Oak Ridge National Laboratory Pit Rise project.

For more information:

OST/TMS ID 2171

William R. Hamel
University of Tennessee
423–974–5275
whamel@utk.edu

Vijendra P. Kothari, DOE-NETL
304–285–4579
vijendra.kothari@netl.doe.gov

Integrated D&D Decision Analysis Tool

Objective and Scope: The objectives of this work are to develop a computer-based Survey Module, update the existing computer-based Decontamination and Decommissioning Technology Database Module, integrate the Survey Module and the D&D Technology Module and distribute the integrated software. FedTech, Arrey Industries, NES, and Research Triangle Institute have teamed to accomplish this effort. The existing D&D Technology Database Module being updated under this task was developed under a previous contract with Arrey Industries, NES, NEXI and Research Triangle Institute. The Survey Module will be able to cost effectively assist in preparation and execution of plans for initial facility surveys, operational surveys during D&D work and final facility release surveys. The Survey Module will estimate the budget, schedule, labor, radiation dose, waste generation, and equipment requirements to perform these surveys along with defining the number and location of survey points and recommended survey instruments. The Survey Module will integrate the collection, storage and reporting of survey data.

Current Reporting Period Activities:
No activity to report.

For more information:

OST/TMS ID 173

Jim Carey, Energetics
304–594–1450

Steve Bossart, DOE-NETL
304–285–4643
steven.bossart@netl.doe.gov

Modular Manipulator for Robotic Applications

Objective and Scope: This project focuses on the needs of Automated Plutonium Processing (APP) tasks that involve the manipulation of plutonium containers and the transfer of their contents. Specific challenges of APP glove boxes include restrictive entry ports, confined workspace, limited maintenance access and destructive plutonium particulates, which make this task virtually impossible to automate with existing technology.

In order for automation systems to be successful within DOE facilities; they must provide maximum functionality, flexibility, ease of use and reliability, while facilitating the rapid deployment of each custom system. This work concentrates on in-depth design and deployment of self-contained actuator modules, which will be used to construct a robotic manipulator tailored for APP tasks. A human-scale manipulator will be built from two sizes of DISC Actuator and will replace existing human labor within plutonium gloveboxes. The modular nature of ARM Auto-mation's technology readily enables installation and maintenance of automation within "hot" boxes.

Status and Accomplishments: A survey of the state-of-the-art modular manipulators design is completed. This survey addresses modular manipulators developed inside government laboratories, universities and private industry for such applications as space exploration or control research and commercially viable industrial applications. Based on this study, it is possible to define the requirements of one manipulator system that can be used to conduct automated transfer operations within plutonium glove boxes and some D&D applications.

Current Reporting Period Activities: The test plan for the testing the manipulator at ARM's facility was initiated. This effort included determining the best manipulator configuration to fit in a glovebox. A solid model of a glovebox was obtained from Sandia Notional laboratory to aid in this effort. ARM Automation will deliver the actuator to the University of Texas (UT) to test the actuators in their testbed, which was prepared at UT.

For more information:

OST/TMS ID 2199

Joseph Geisinger, ARM Automation
512–894–3534
joewg@armautomation.com

Vijendra Kothari, DOE-NETL
304–285–4579
vijendra.kothari@netl.doe.gov

3.0 Programmatic Structure and Organization

Within the Environmental Management (EM) organization, the Office of Science and Technology (EM-50), formerly the Office of Technology Development, has the overall responsibility to develop and demonstrate technologies and systems to meet DOE's needs for environmental restoration and waste management. The office works closely with the EM Offices of Waste Management (EM-30), Environmental Restoration (EM-40), and Nuclear Materials and Facilities Stabilization (EM-60) in identifying, developing, demonstrating,and deploying innovative, cost-effective technologies and systems. Activities within EM-50 include research, development, demonstration, testing, and evaluation (RDDT&E); technology integration; technology transfer; and program support.

Program Structure

To focus DOE efforts on the most urgent needs, EM-50 has established four focus areas that address DOE's most pressing problems:

- Deactivation and Decommissioning (D&D)
- High-Level Waste Tank Remediation
- Mixed Waste Characterization, Treatment, and Disposal
- Subsurface Contaminants Containment and Remediation

In addition, EM-50 has established three crosscutting technology areas that conduct efforts where technology needs and targets are relevant to more than one focus area. The crosscutting areas are:

- Characterization, Monitoring and Sensor Technology (CMST)
- Efficient Separations and Processing (ESP)
- Robotics

"It's time we elevate the profile and prestige of this world-class facility, which has been helping solve energy and environmental problems for more than 50 years,"

Bill Richardson, U.S. Secretary of Energy, National Energy Technology Laboratory Dedication Ceremony

The Industry Program conducts competitively selected activities that involve the private sector in developing, demonstrating, and implementing improved technologies that address the needs of the focus areas and the crosscutting areas.

The result of this structure of programs is that the D&D Focus Area is positioned to support those research areas defined as highest priority by EM-50 and DOE customers.

The Role of NETL

The Federal Energy Technology Center, with physical sites in both Pittsburgh, Pennsylvania and Morgantown, West Virginia, was redesignated by U.S. Secretary of Energy Bill Richardson, as the National Energy Technology Laboratory (NETL). As the 15th national laboratory, NETL becomes part of the national laboratory research system. This is the largest research system of its kind in the world with more than 30,000 engineers and scientists conducting research and research and leading-edge experiments. As part of this system, the new National Ener

gy Technology Laboratory will join Argonne National Laboratory (Illinois); Brookhaven National Laboratory (New York); Lawrence Berkeley National Laboratory (California); Fermi National Accelerator Laboratory (Illinois); Idaho National Engineering & Environmental Laboratory (Idaho); Lawrence Livermore National Laboratory (California); Los Alamos National Laboratory (New Mexico); National Renewable Energy Laboratory (Colorado); Oak Ridge National Laboratory (Tennessee);
Pacific Northwest National Laboratory (Washington); and Sandia National Laboratories (New Mexico and California).

Rita A. Bajura, NETL Director, a career federal executive with more than 18 years experience in government-industry energy partnerships, continues in her leadership position as head of the single management team that serves both physical sites with a combined working force of more than 530 federal scientists, engineers, and administrative staff. NETL is responsible for nearly 600 research projects; most

involving the development of advanced fossil fuel technologies.

In addition to the new national laboratory's core capabilities, Secretary Richardson announced that a newly created Center for Advanced Natural Gas Studies, would be an integral part of NETL's research endowment.

Senator Robert C. Byrd, (WV) remarked in the course of the dedication that, "Much of the laboratory's work is dedicated to the worthy goal of developing innovative, clean and efficient technologies that will allow our nation to meet its growing energy needs. As the nation's newest national laboratory, it will continue to help light a pathway for a new era of energy use that will ensure a comfortable standard of living for our children and our children's children."

NETL also manages a significant portion of the technology development needed to clean up sites in the government's nuclear weapons complex. In February 1995, the then Morgantown Energy Technology Center was selected by EM-50 to be the implementing organization for the D&D Focus Area. As such, it brought the experience gained from being the implementing organization for the Industry Program, which competitively selects industrial R&D performers through Research Opportunity Announcements (ROAs) and Program Research and Development Announcements (PRDAs). As the lead organization for D&D implementation, NETL is responsible for the planning, monitoring, and evaluating RDDT&E projects to meet the requirements of EM-50 and its customers in EM-30, EM-40, and EM-60.

▼ Stakeholder Feedback

The stakeholders in the D&D Focus Area include DOE headquarters; DOE operations offices; DOE sites and their operating contractors; D&D technology developers and users in the private sector; federal, state, and local regulators; and the communities around affected DOE facilities. These stakeholders have been providing input to focus area planning and implementation; program contacts are provided on the first page of this report.

4.0 Background

The D&D Focus Area was established to develop and demonstrate improved technologies and systems that could solve customer-identified needs to characterize, deactivate, survey and maintain, decontaminate, dismantle, and dispose of or recycle DOE surplus facilities and their contents. The mission also includes facilitating the acceptance, approval, transfer, commercialization, deployment, and implementation of these technologies and systems.

These technologies are needed to address the pressing needs of deactivating more than 7000 contaminated buildings and decommissioning more than 700 buildings. In addition, material disposition is required for over 600,000 tons of metal and 23 million cubic meters of concrete in contaminated buildings and for 400,000 tons of metal currently in scrap piles. The major drivers for this focus area are the high safety and health risks associated with working in aged and contaminated facilities and the high costs associated with facility deactivation, sur-veillance, and maintenance using currently available baseline technologies.

D&D Focus Area Strategy

Subsequent to the selection of NETL as the lead organization for the D&D Focus Area, a program review of all FY95 projects was held in May 1995. Based on this and other recent program reviews, as well as the general requirement for fiscal constraint throughout, the following strategies were developed:

Programmatic Strategy

- Focus D&D technology development program on large-scale demonstrations emphasizing full-scale demonstrations using a suite of improved technologies.
- Demonstrate technologies only through large-scale demonstrations.
- Focus on technologies that are identified as high priority by customers, that have wide applicability, and that have a commitment to be considered for use by customers.
- Emphasize demonstration and deployment of private-sector technologies.
- Technical Strategy

In the near term, emphasize technologies to effectively support:

- deactivation of facilities,
- decontamination of surfaces,
- reuse of bulk contaminated materials,and
- application of remotely operated dismantlement systems

In the middle term, emphasize technologies to effectively support:

- applications of remote surveillance systems,
- characterization of volumetrically contaminated materials,
- decontamination of bulk materials, and
- adoption of release standards for bulk contaminated materials.

Large-Scale Demonstrations

A cornerstone of the D&D Focus Area is its series of large-scale demonstration and deployment projects. The LSDDPs demonstrate innovative and improved D&D technologies at full scale, side by side with existing commercial technologies. The intent is to compare benefits from using a suite of improved and innovative D&D technologies against those associated with baseline D&D technologies. This approach provides an opportunity to test improved and innovative D&D technologies at a scale that will provide meaningful cost and performance information to the potential end-users of the technology.

5.0 Upcoming Events

We list conferences and workshops of interest to our readership. Please let us know if you would like us to include your event on this page.

Contact: Wade Walker
RIO Technical Services
817–735–8264,
wade.walker@riotechnical.com